

Master Cover Certification Report

**Industri-Plex Site
Woburn, Massachusetts 01801**

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1.0 INTRODUCTION

The Industri-Plex Site Remedial Trust (Remedial Trust) is required by the Consent Decree entered on April 24, 1989 by the United States District Court for the District of Massachusetts in the matter styled United States v. Stauffer Chemical Company et al., Civil Action No. 89-0195-MC, and Commonwealth of Massachusetts v. Stauffer Chemical Company et al., Civil Action No. 89-0196-MC, and recorded at the Middlesex South Registry of Deeds in Book 19837, Page 476 (Consent Decree) to fund and administer the obligations of the Consent Decree. At the request of the Remedial Trust, Roux Associates, Inc. (Roux Associates) has prepared this Master Final Cover Certification Report (Cover Certification Report) in compliance with the Consent Decree requirements. This Master Cover Certification Report documents the Site wide completion of the Remedial Action for soil, sediments, and air at the Industri-Plex Superfund Site (Industri-Plex Site), Woburn, Massachusetts. Roux Associates prepared the following 26 property specific Cover Certification Reports for 31 Tax Map lots in compliance with the Consent Decree requirements:

- Pacer Headquarters, Inc. (Tax Map 10-1-2)
- Resource for Responsible Site Management – South Hide Pile & Detention Basin (Tax Map 10-1-6)
- Koster Revocable Trust – Parcel 1 (Tax Map 4-7-9)
- Koster Revocable Trust – Parcel 2 (Tax Map 9-2-1)
- Koster Revocable Trust – Parcel 3 (Tax Map 9-2-5)
- Koster Revocable Trust – Parcel 4 (Tax Map 9-2-6)
- Aero Realty Trust – Parcel 1 (Tax Map 9-2-3)
- Aero Realty Trust – Parcel 2 (Tax Map 9-2-4)
- PX Realty Trust – Parcel 1 (Tax Map 9-1-7)
- PX Realty Trust – Parcel 2 (Tax Map 9-1-8)
- Positive Start Realty (Tax Map 9-1-6)
- WJP Realty Trust (Tax Map 9-7-4)
- Stephen & Adeline Dagata (Tax Map 9-2-7)
- 20 Atlantic Avenue Realty Trust (Tax Map 10-1-5)
- Atlantic Avenue Associates, Inc. (Tax Map 10-1-8)
- Mid A Terrace, LLC (Tax Map 10-1-4)
- Boston Edison Company – Parcels 1, 2, 3 and 4 (Tax Maps 9-2-8, 9-7-3, 9-1-5 and 15-1-11)
- Nodraer Realty Trust (Tax Map 10-1-3)

- Sunder K. & Hiro K. Ganglani (Tax Map 10-1-10)
- Chestnut Hill Realty Trust (Tax Maps 10-1-9, 10-1-11 and 10-1-12)
- Massachusetts Bay Transportation Authority (Tax Map 31-2-2)
- City of Woburn (Tax Map 10-1-17)
- Resources for Responsible Site Management – East Hide Pile, West Hide Pile and Wetlands 1C (Tax Map 5-1-1)
- Resources for Responsible Site Management – Undeveloped Property (Tax Map 5-1-3)
- Tabby Associates, LLC (Tax Map 4-7-1)
- Rights of Ways and Roads (No Tax Map)

Construction of the Remedial Action for soil, sediment, and air was completed on June 28, 1996, with the subsequent completion of quality assurance/punch list items as required by EPA and shown on the As-Built Record Drawings. Changes to the cover on the Site may have been made since that date. Approved changes to the cover are documented in the Administrative Record for the Industri-Plex Site.

In accordance with the Consent Decree and the Contract Documents for the Remedial Action, a certification report must be prepared by a registered professional engineer certifying that all remedial activities have been completed in full satisfaction of the requirements of the Consent Decree. As defined by EPA, (Federal Register, July 26, 1982) certification does not constitute a guarantee or warranty, but a “rendering of a professional opinion concerning compliance with a requirement of the regulations by a qualified professional in the field.”

1.1 Site Description and History

The Industri-Plex Site is a 245 (+/-) acre area, located about 10 miles northwest of Boston, Massachusetts in the north part of Woburn, within the Aberjona River Valley. The Site is bounded on the east side by Interstate 93, and Interstate 95/State Route 128 is located about one half mile south of the Site. The Boston Edison Power Company right-of-way No. 9 is the southwest boundary of the Site. The Massachusetts Bay Transportation Authority (MBTA) railway transects roughly the western third of the Site in a northwest-southeast direction. The Industri-Plex Site was surveyed by SAIC Engineering, Inc. and Liu Aerial Surveys in 1990 and 1991.

Since the mid-1800s, the Industri-Plex Site has been used primarily by companies producing chemicals for textile, leather, and paper. Chemical manufacturing operations occurred at the Site from 1853 to 1931, producing sulfuric acid and related chemicals, arsenic insecticides, acetic acid, dry colors, phenol, benzene, picric acid, toluene and trinitrotoluene (TNT). By 1929, the Merrimac Chemical Company, which occupied the Industri-Plex Site, had become one of the leading producers of insecticides and other chemicals in the United States. The Merrimac Chemical Company plant included 90 buildings on 417 acres, many of which were within the current Industri-Plex Site. Early operations included disposal of wastes in pits or low-lying wetlands. Liquid wastes were discharged into streams and later sewers. As a result, heavy metal wastes from the chemical operations contaminated Site soils and wetland sediments.

From 1934 to 1969, the property was used by several companies to manufacture glues and gelatins from animal hides. Raw, salted or limed hides, hide fleshings, or chrome tanned leather scraps from cattle, hogs, sheep or other animals were used to manufacture glue by extracting a protein called collagen from animal tissues or bones. Animal hide waste products from the rendering process were disposed of in mounds or hide piles on-Site. A developer purchased the plant property in the early 1970s intending to build a complex of industrial buildings (hence Industri-Plex) and began grading operations. During hide pile excavation, noxious gases and odors, attributable to the decomposing hide wastes, were released. The distinctive odor became known as the “Woburn odor.” Complaints from local residents and encroachment on wetland areas stopped further development of the Site.

In 1981, the United States Environmental Protection Agency (EPA) proposed the Industri-Plex Site for the National Priorities List (NPL), also known as Superfund. The Industri-Plex Site was finalized on the NPL in 1983. In May 1982, EPA and the Massachusetts Department of Environmental Quality Engineering [DEQE – currently known as the Massachusetts Department of Environmental Protection (MassDEP)] entered into a Consent Order with Stauffer Chemical Company to undertake a Remedial Investigation/Feasibility Study (RI/FS). In April 1985, Phase II of the RI/FS was completed. The Remedial Investigation identified arsenic, lead, and chromium in Site soils and wetland sediments as well as impacts to the ground water and odors due to hydrogen sulfide and methyl mercaptans emitted from the hide piles. Abandoned buildings and waste lagoons were also present on the Site. Based on the RI/FS, EPA, along with MassDEP, established a Record of Decision (ROD) in 1986 for the first phase of the cleanup at

the Industri-Plex Site (known as Operable Unit 1, OU-1), which included a protective cover over more than 100 acres of soil contaminated with heavy metals and animal wastes, a gas collection and treatment system, institutional controls, an interim groundwater remedy, as well as further investigations of Site-related contamination at and downstream of the Site to support a future second phase (known as Operable Unit 2, OU-2). The location of the protective cover is illustrated in Attachment 1, which includes an impermeable cover for the gas collection and treatment system situated at what is known as the East Hide Pile.

Further details of the Industri-Plex Site history can be found in the 1986 Record of Decision.

In a 1989 Consent Decree between EPA, MassDEP and the current and former property owners, two Trusts were established which set in motion the remediation and reuse of the Industri-Plex Site. The Remedial Trust was formed to prepare and implement the remedy according to the ROD. The Industri-Plex Site Custodial Trust (Custodial Trust) was formed to hold, manage, and sell a portion of the Site.

Golder Associates, Inc. (Golder) was selected in 1989 by the Remedial Trust to design the remediation for the Industri-Plex Site. The remedial design included pre-design investigations of the soils, wetlands, air, and groundwater.

The pre-design investigations included sampling analysis and studies to determine the extent of contamination and, in accordance with the Consent Decree, to evaluate cover types. Designs were needed to prepare the ground surface for cover. The remedial design included:

1. Plans for the demolition or decommissioning of abandoned buildings, railroad tracks, underground utilities, a personnel tunnel, and over 120 existing observation wells and piezometers used during the preliminary investigation.
2. Plans for controlling odors, fugitive dusts, and surface water runoff during construction to prevent off-Site impacts.
3. Evaluation of, and considerations for the future stability of, the hide pile slopes.
4. Plans for collecting and treating waste gases in a Thermal Oxidation Unit.
5. Plans for dredging, remediating, and revitalizing streams and wetlands.

The remedial design for contaminated soils and air included both permeable (soil and geotextile) and impermeable (soil and geomembrane) covers. A permeable cover system was designed for 60 acres of upland soils and three hide piles (known as the West, East-Central and South Hide Piles) contaminated with high concentrations of heavy metals and decomposing organic wastes. The permeable cover included a geotextile base to maintain separation between contaminated soils and clean cover material, a clean grading fill, and topsoil with vegetation. An impermeable cover was designed for a fourth hide pile (known as the East Hide Pile) which was approximately four acres in size and an active odor source. The impermeable cover included a high permeability gas collection layer, geomembrane, cover grading fill, topsoil, and vegetation. An active gas collection system was designed to collect gases trapped by the impermeable cover and convey the gases to a Thermal Oxidation Unit for treatment. The permeable cover system for the Site was further divided into two categories: "Engineered Cover"; and "Equivalent Cover". The Engineered Cover was designed and constructed by the Industri-Plex Site Remedial Trust as part of the response activities at the Site to prevent exposure to contaminated soil, and may be comprised of one or more of the following materials: geotextile, geomembrane, soil, gravel, bituminous concrete and/or asphalt. The Equivalent Cover represents existing structures serving as an adequate permeable cover. Equivalent Cover, although not designed as part of the Engineered Cover, functions to prevent exposure to contaminated soil, and may be comprised of one or more of the following ground covering structures or features, or portions of such structures or features: buildings; foundations; slabs; paved driveways, walkways, parking lots and/or roads; or other such ground covering structures or features. The location of Engineered and Equivalent Covers are illustrated in the Record Drawings.

Site remediation also required capping approximately five acres of contaminated streams and wetland sediment. Approximately seven acres of wetland enhancement, restoration, and creation were designed to compensate for wetland losses. Normandeau Associates, Inc. of Bedford, New Hampshire, was a key designer of the wetland mitigation plans.

A revised final (100%) Design Report was issued on May 8, 1992. Approval for the 100% Design Report was issued by EPA in consultation with the MassDEP on May 18, 1992. A Remedial Action Work Plan for Soil, Sediment and Air Remedy was issued on June 22, 1994, and approved by EPA, in consultation with MassDEP, on July 11, 1994.

1.2 Scope of the Remedial Action

The Remedial Action (RA) implemented the Remedial Design prepared by Golder and distributed for bidding in April 1992. The RA included covering metal-contaminated soils encountered over an approximately 100-acre portion of the 245-acre Site shown on Sheets A-3 and A-4 of Attachment 1. This certification addressed the Site-wide remedial action performed according to the 100% Design Report. The remedial action on the Site included a designed permeable cover of clean soil, riprap, asphalt pavement, or gravel overlying a geotextile layer that was placed directly on prepared existing ground, fill soil, the South Hide Pile, the East Central Hide Pile and the West Hide Pile. The remedial action on the East Hide Pile included a designed permeable cover of clean soil, riprap, or gravel overlying a geotextile layer that was placed directly on prepared existing ground, designed impermeable cover of clean aggregate overlying a geotextile and 60-mil HDPE geomembrane layers that were placed directly on prepared existing ground or fill soil, and a system of gas collection piping and vaults connected to a thermal oxidizer unit.

This certification does not include a section of RRSM (Tax Map 5-1-1) located along Commerce Way Extension east of Chestnut Hill Realty Trust (Tax Map 10-1-11) and west of City of Woburn (Tax Map 10-1-17). That section of RRSM was certified as part of the Regional Transportation Center (RTC) cover certification prepared by Golder, and approved by EPA on April 29, 1998.

Work conducted between 1992 and December 1997 is addressed in this report.

This report includes the following information as it pertains to the remedial action performed on the Industri-Plex Site:

- Relevant portions of the Final 100% Design Report (**Appendix A**);
- The submittal log (**Appendix B**);
- Modifications of specifications and plans (**Appendix C**);
- Results of Site air and surface water monitoring (**Appendix D**);
- Decommissioning of wells, piezometers, gas vents, and unidentified wells (“UIDs”) (**Appendix E**);
- Results of soil conformance and in-place material testing during the Remedial Action (**Appendix F & G**);

- Results of geosynthetics conformance material testing (**Appendix H**);
- Observation and testing associated with the installation of the impermeable cover (**Appendix H**);
- Observations of subgrade preparation, and geosynthetic installation (**Appendix I**);
- Created Wetland Cover System and Final Vegetation Establishment and Soil Stabilization Plans (**Appendix J**);
- Details of the Thermal Oxidation Unit (**Appendix K**); and
- Review of lines and grade control.

1.3 Report Format

This Master Cover Certification Report documents the completion of the soil, sediment and air remedies at the Site (excluding MassPort Authority property documented in the April 1998 RTC Cover Certification Report). This Master Cover Certification Report presents a generic description of all work performed to complete the soil, sediment and air remedies. Specific details regarding design changes and property specific details are provided in the record drawings (Attachment 1) and herein. Property specific details are also provided separately in the property specific Final Cover Certification Reports containing property-specific details and record drawings for 31 Tax Map lots at the Site.

2.0 PROJECT PARTICIPANTS

In July of 1989 Golder was retained by the Remedial Trust to prepare the Remedial Design for the Site. The Consent Decree included the Remedial Design/Remedial Action Plan (RDAP). The RDAP required the preparation of Pre-Design Investigations and a Remedial Design. The design was executed in accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended and re-authorized. From 1990 to 1992 Golder prepared Preliminary, Intermediate, Pre-Final and Final Design Reports in conformance with the RDAP.

The Remedial Trust entered into an agreement with Chemical Waste Management, Inc. Remediation Services Group of Princeton, New Jersey, (CWM, also Contractor) to perform the Remedial Action in accordance with the RDAP and the Remedial Design plans and specifications. The name of the Contractor changed January 1, 1993 when CWM was acquired by Rust Remedial Services Inc. (Rust), then again in May of 1995 when OHM acquired Rust. The name Chemical Waste Management was retained as the legal name of the Contractor throughout the period covered by this report.

Several subcontractors assisted the Contractor with specific tasks during the remedial work. A list of the subcontractors and the services they provided is presented below:

Rust Environment and Infrastructure, formerly SEC Donohue Inc., of Burlington, Massachusetts provided engineering support;

Earth Tech Inc. (Earth Tech), formerly HMM Associates Inc., of Concord, Massachusetts provided surveying services from 1992 to 1993 and Meridian Land Services Inc. (Meridian) of Milford, New Hampshire provided surveying services from 1993 to 2001. Both surveying companies collected field documentation that would be used to establish the as-built drawings for this report;

- Eastmont Environmental Inc. of Walpole, Massachusetts conducted perimeter air monitoring;
- Beattie Enterprises of Lancaster, New Hampshire assisted with clearing and grubbing the Site;

- Maher Environmental Services (Maher), formerly D.L. Maher Company, of Reading, Massachusetts decommissioned the wells and piezometers;
- Barbella Environmental Technology Inc. of Whitehouse, New Jersey assisted in the hide pile remediation;
- National Seal Company of Galesburg, Illinois installed the 60 mil high density polyethylene (HDPE) geomembrane;
- NAO, Inc., of Philadelphia, Pennsylvania designed and provided the thermal oxidizer unit for the East Hide Pile,
- Datatest Industries, Inc. of Hillsborough, New Jersey designed and installed the Continuous Emissions Monitoring System for the thermal oxidizer at the East Hide Pile;
- Toxikon Laboratories, of Woburn, Massachusetts, and 21st Century Environmental Inc. of Bridgeport, New Jersey, assisted the Contractor with water and soil analytical testing; and,
- Reliable Fence Company of Woburn, Massachusetts installed chain link fence on the Site.

In accordance with the Consent Decree, EPA contracted with Halliburton NUS (HNUS) of Wilmington, Massachusetts to provide technical oversight. Representatives of EPA and the (MassDEP) met with the Remedial Trust monthly (approximately) throughout the Remedial Action to oversee the performance of the work. Minutes of the meetings were recorded but are not included in this report.

Golder provided engineering quality assurance (QA) for the Remedial Action from September 1992 through December 1995. QA included examining and testing materials and procedures to verify and assure the Remedial Trust that the construction conformed to the specifications and drawings. The Remedial Trust directed Golder to perform a geophysical investigation during May 1993. Golder Construction Services Inc. (Golder Construction) provided on-Site construction management services for the Remedial Trust from March 1995 through December 1995.

The Remedial Trust contracted with Professional Service Industries, Inc. (PSI) of Canton, Massachusetts to perform soil moisture/density testing of compacted soils, soil laboratory testing, and asphalt testing. PSI also performed on-Site QA testing from August 1993 through December 1995.

During 1995, the Remedial Trust contracted with de maximis, inc. to be the Site manager for the Remedial Trust and to coordinate the work conducted by Golder, CWM, and other contractors. In 1998, the Site manager role was assumed by Maverick Construction Management Services, Inc. (Maverick). Following remedial construction activities, the Remedial Trust contracted directly with Maverick to coordinate the documentation of as-built cover conditions, to manage construction activities necessary to bring the cover into compliance with the 100% Design and to prepare a Draft Cover Certification Report. In 2007, the Remedial Trust contracted with Roux Associates to complete the certification of the cover, including the completion of the draft and final Cover Certification Report.

3.0 CONSTRUCTION DOCUMENTS

RD/RA Work performed for the Remedial Trust was completed according to the documents, plans, and specifications described in Sections 3.1 through 3.4.

3.1 Consent Decree

The Consent Decree (EPA, 1989) entered into between the Plaintiffs [i.e., EPA and the MassDEP (Agencies)] and the Settlers defined the work that was to be undertaken at the Site. This definition is within the Consent Decree as well as the RDAP. The Consent Decree was based on the Record of Decision (ROD) for the Site (EPA, 1986). While the Consent Decree, the RDAP, and the ROD were consulted for the specific definition of the remedies to be implemented at the Site, the RDAP generalized the remedy and formed the basis for Golder's preparation of the Remedial Design Work Plan and ultimately the Final 100% Design Report. This certification applies to the Consent Decree but the primary component is the RDAP.

3.2 100% Design Report and Addenda

Golder developed the design and specifications and produced the "Final 100% Design Report, Part I" for the Industri-Plex Site (Appendix A), which was submitted to EPA and MassDEP in December 1991. This report applied to the remedy for soil, sediments, and air for the Site. Other Consent Decree requirements were deferred in accordance with the Agencies' instructions. The Agencies provided comments on the 100% Design Report, and responses to those comments were submitted April 3, 1992. A revised final 100% Design Report was issued April 3, 1992. The 100% Design was issued for bid April 25, 1992. The 100% Design Report was approved on May 18, 1992.

Subsequent addenda were issued for the 100% Design Report including the following:

Addendum 1 issued May 1992 (EPA/MassDEP Approval March 11, 1993)

Addendum 2 issued June 1992 (EPA/MassDEP Approval March 11, 1993)

Addendum 3 issued May 14, 1993 (EPA/MassDEP Approval May 27, 1993)

Addendum 3 revision 1 August 27, 1993 (EPA/MassDEP Approval September 10, 1993)

Addendum 3 revision 2 October 18, 1993 (EPA/MassDEP Approval November 2, 1993)

On October 1, 1996, EPA approved an alternative permeable cover design for the Regional Transportation Center (RTC) entitled RTC Alternate Cover Design (Golder, 1996). Details of the

construction and certification of the RTC Alternative Cover Design are presented in the RTC Cover Certification Report (Golder, 1998), which was approved by EPA on April 29, 1998. The remedy design for a portion of the RRSM (Tax Map 5-1-1) property located along commerce way extension was altered from the 100% Design Report in accordance with the RTC Alternative Cover Design (Golder, 1996) and RTC Cover Certification Report (Golder, 1998).

3.3 Remedial Action Work Plan

According to the Consent Decree, the Remedial Action Work Plan (RAWP) was to be submitted to the Agencies within sixty (60) days after EPA and the Commonwealth received notification of the selected Remedial Action Contractor. The RAWP was prepared by the Remedial Action Contractor for the Remedial Trust to implement the Site remedy consistent with the approved design for each Site area. The Consent Decree required that the RAWP contain:

- (1) A description of all the activities necessary to implement the Remedial Actions; and
- (2) A timetable for the completion of all these activities, which shall also identify major and minor milestone events in the Remedial Action process. The schedule of significant events shall be consistent with Attachment D, [Project Schedule and Remedial Design/Action Milestones].

On August 18, 1992, prior to EPA's receipt, review, and acceptance of the RAWP the Remedial Trust requested EPA and MassDEP approval of a preparatory, non-intrusive work plan for work that would begin in September. Submittal of this work plan allowed the Contractor to maximize the construction work season while awaiting final approval of the RAWP. An addendum to the August request was submitted to EPA and MassDEP on October 9, 1992 expanding the earlier request to include debris removal and non-intrusive work and above ground structure demolition. Both the August 18 and October 9 requests were tacitly approved by EPA in consultation with MassDEP. As required, the Remedial Trust submitted a RAWP to EPA on October 5, 1992 (Consent Decree Attachment, Section B, Subsection 3B).

An interim RAWP was submitted to EPA on October 22, 1992 with a request to begin work west of the MBTA railroad tracks. EPA in consultation with MassDEP provided comments on the interim RAWP on November 25, 1992 and a revised interim work plan was submitted to EPA in December 1992. With EPA and MassDEP concurrence, the Remedial Trust authorized the Contractor to begin remediation of the Site on December 2, 1992.

EPA's review of the original RAWP, in consultation with MassDEP, continued through the first half of 1993. EPA, in consultation with MassDEP, provided a conditional approval of the RAWP on March 11, 1993. The Agencies had two main concerns, 1) "the effect of the proposed groundwater treatment changes on the 'Created Wetlands' (CW); and 2) the maintenance of air and stream water quality (ARARs) during the construction of the Remedy." EPA, after consultation with MassDEP, requested the following: 1) a revised CW design with a buffer and separation from the groundwater; and 2) implementation of a program for surface water sampling for contaminants.

Following the Remedial Trust's responses, EPA after consultation with MassDEP, presented an approval of the RAWP on May 19, 1993, contingent upon: 1) sampling of surface water to measure water quality; 2) resolution of water treatment design questions; 3) provision of a copy of the Contractor drilling and blasting plan; and 4) a requirement to cover all frequently used roads with a minimum of 4 inches of crushed stone. On July 2, 1993, EPA, after consultation with MassDEP and the Remedial Trust, reached an agreement on procedures for testing surface water and revisions to the CW.

Erosion and sediment control issues prompted further revisions to the RAWP. On March 1, 1994, a major revision to the RAWP was submitted to EPA. EPA, after consultation with MassDEP, approved the revision on July 11, 1994. Subsequent revisions were submitted and the latest version of the RAWP at the preparation of this report is August 21, 1995.

3.4 Health and Safety Plan

A Health and Safety Plan (HASP), prepared by CWM and dated August 1992, for the remediation of the Site was transmitted to EPA, after consultation with MassDEP, on September 2, 1992. The submission was made in fulfillment of the requirements to the Consent Decree Appendix I, Section F. The Remedial Trust was informed at the March 22, 1993 meeting that EPA, after consultation with MassDEP, would not approve the HASP but would provide comments. The HASP was revised on March 16, 1994; December 20, 1994; May 5, 1995; and June 29, 1995 largely to address changes to the Emergency Response Plan. In accordance with the Agencies' policy, the HASP was reviewed but not approved. The latest version of the HASP as of this report is June 29, 1995.

4.0 REMEDIAL DESIGN/ACTIONS

4.1 Soil Remedy

The soil remedy for the Site involved covering on-Site soils containing lead, arsenic, or chromium at or above the action levels established by the Consent Decree with permeable soil cover. An impermeable cover was designed for a four-acre hide pile (East Hide Pile) on Site, which was an active odor source.

4.1.1 Soil Remedy - Consent Decree Requirements

The RDAP is included as Appendix I of the Consent Decree. Throughout the RDAP, the remedy for the Site is referred to as the “cap”. However, the 100% Design refers to the Site remedy as the “cover”. The term “cover” has been retained for the text of this report, excluding the RDAP.

Page 1 of the RDAP states the following:

“The remedial action for soils, sediments, and sludges contaminated with Hazardous Substances, other than those emitting odors (the East Hide Pile), shall include site grading, capping with a permeable soil cover, excavation, dredging, and/or consolidation for all areas containing Hazardous Substances at concentrations above established action levels (arsenic = 300 ppm, lead = 600 ppm, chromium = 1,000 ppm)....”

Furthermore the RDAP states, “Settlers shall design and implement remedial action for soils contaminated with Hazardous Substances above the action level for metals that shall consist of site grading and capping together with Institutional Controls. Areas already covered adequately by buildings, roadways, parking lots, or other ground covering features, would not receive cover material, instead allowing the structures themselves to act as the protective cap.

For small areas on-Site, such as the landscaped areas between buildings and parking lots, Settlers may propose location-specific alternatives to capping consisting of excavation of contaminated soil and consolidation on-site with similarly contaminated soils, or placement of a protective layer such as asphalt to cap the contaminated soils.

Settlers shall design and implement the remedial actions for contaminated soils in accordance with the following requirements:

(1) cap design and construction activities shall be in accordance with regulations and/or guidance on cap design for permeable covers as summarized in [RDAP] Attachment A ... provided that an alternative permeable cap design including a permeable synthetic fabric and a soil layer less than 30 inches in depth, may be used in all areas of the Site where Settlers demonstrate to EPA and the Commonwealth that the alternative cap design will perform as well as or better than the permeable cap design summarized in Attachment A.”

Attachment A to the RDAP states that:

“Permeable covers shall be designed and constructed to include at a minimum the following:

A. A vegetated top layer which shall be:

1. of a minimum thickness of six (6) inches;
2. capable of supporting vegetation that minimizes erosion and minimizes continued maintenance;
3. planted with a persistent species with roots that will not penetrate into the contaminated soils;
4. designed and constructed with a top slope of between 3 percent and 5 percent after settling and subsidence or, if designed and constructed with less than 3 percent, a drainage plan to ensure that the ponding of surface water does not occur or, if designed and constructed with a slope of greater than 5 percent, an expected soil loss of less than 2 tons/acre/year using the USDA universal soil loss equation; and,
5. designed and constructed with a surface drainage system capable of conducting effective run-off across the cap.

B. A base layer that shall be:

1. of a minimum thickness of twenty-four (24) inches of appropriate fill material; and,
2. designed and constructed to prevent clogging.”

Two alternative permeable covers were designed as part of the remedy under the Consent Decree. The first alternative permeable cover design concept utilizing a 16-inch thick borrow cover overlaying a geotextile was developed in the Alternative Cover Design Report (Golder, 1989). This design was subsequently approved by the EPA and MassDEP in a letter dated September 11, 1989. The second alternative permeable cover design was the design to accommodate the RTC Alternative Cover (VHB/Golder, 1996). The EPA, in consultation with

the MassDEP, approved the RTC Alternate Cover design in a letter dated October 1, 1996. The RTC Alternative Cover was properly constructed and documented in the RTC Cover Certification Report (Golder, 1998), approved by EPA on April 28, 1998.

4.2 Sediment Remedy

4.2.1 Sediment Remedy – Consent Decree Requirements

The Consent Decree (EPA, 1989) briefly explains the work to be performed and establishes the requirements for remediation of sediments presented in the RDAP. Sediments within streams and wetlands where there are “no odor-emitting Hazardous Substances (e.g. hide wastes), Settlers shall dredge the Hazardous Substances or remove them by another method shown to be environmentally protective and approved by EPA in consultation with the Commonwealth”.

The RDAP mandates “an in-situ cover for areas with sediments containing Arsenic, Lead, and/or Chromium at or above Consent Decree action levels, and hide residues, stipulating that these capping activities will be consistent with other technical requirements of the RDAP”.

The RDAP also requires that excavated sediments be “consolidated in other areas of the Site which contain such Hazardous Substances and which will be covered as part of the approved remedial action”.

4.3 Air Remedy

4.3.1 Air Remedy - Consent Decree Requirements

The RDAP, which is included as Appendix I of the Consent Decree, outlines general guidelines for the air remedy for the East Hide Pile. The RA for the control of air emissions was designed “to mitigate the release or threat of release of Hazardous Substances, including odors associated with decaying hide waste, in the East Hide Pile”.

The RA consists of:

- (a) “stabilizing the side slopes of the East Hide Pile;
- (b) installing a gas collection layer;
- (c) capping with a synthetic membrane to establish impermeability
- (d) [installing] soil cover in accordance with Attachment A; and
- (e) treating gaseous emissions with either activated carbon or thermal oxidation”.

The RDAP also specifies that a permanent gas treatment system was to be installed after the impermeable cover and gas collection system were constructed and allowed to reach equilibrium. EPA, in consultation with MassDEP, was to specify the final treatment decision regarding the permanent gas treatment system. The decision was to be based on what system proved to be most efficient and cost-effective, in addition to a number of other engineering design criteria.

5.0 SITE CONTROLS AND DOCUMENTATION

5.1 Survey Control

The Contractor utilized Meridian and Earth Tech to provide record survey documentation of the extent of cover, configuration of grading and general as-built conditions of the cover and any buried or concealed construction. The results of these record surveys are provided in Attachment 1. The record drawings are based on the survey control provided in the 100% Design Report plans.

5.2 Construction Control

During the RA work, the Contractor was required by the project specifications to provide controls to maintain a safe work environment and protect the public health and safety. Such controls included air monitoring and surface water monitoring (**Appendix D**).

Air Monitoring

The objective of the ambient air monitoring program was to monitor total reduced sulfur (TRS) compounds and total suspended particulate (TSP) and inhalable particulate (PM10) as well as heavy metals (arsenic, lead and chromium) in TSP at fenceline locations during remediation efforts.

Specification section 01562 - Dust Control of the 100% Design Report required the contractor to employ construction methods and means that would keep airborne particulates below the following action levels:

- PM10 particulates were to be limited to an annual average of less than 150 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) at Site monitoring points; and
- Respirable dust concentrations were limited to 90 $\mu\text{g}/\text{m}^3$ at Site monitoring points and 5,000 $\mu\text{g}/\text{m}^3$ in the worker's breathing zone.

Data gathered by dust monitoring devices was used to monitor metals in the particulates to ensure that they were below the following threshold limit values (TLVs) outlined in the American Council of Governmental and Industrial Hygienists:

Arsenic	Chromium	Lead
0.02 $\mu\text{g}/\text{m}^3$ (of air)	1.36 $\mu\text{g}/\text{m}^3$ (of air)	1.36 $\mu\text{g}/\text{m}^3$ (of air)

Appendix B to Volume 6 of the 100% Design Report provides a detailed Odor Control Plan which specifies that TRS compounds in air at the perimeter of the Site may not exceed 47 parts per billion (ppb).

Eastmount Environmental Inc. conducted ambient air quality testing, beginning in September 1992. The particulates and heavy metals were sampled at four perimeter monitoring locations. TRS sampling was conducted at seven perimeter monitoring locations. See **Appendix D.1** for a map indicating sample points.

TSP and PM10 Sampling

TSP and PM10 samples were collected using Hi-Volume samplers. Each Hi-Volume sampler was programmed to sample at each of the four sample locations from midnight to midnight on six day intervals. In addition to the four sample locations, a duplicate TSP sampler was stationed at Location 4 and a duplicate PM10 sampler was stationed at Location 2. The duplicate TSP sample was also analyzed for metals (arsenic, chromium, and lead).

Eastmount Environmental prepared Hi-Volume Sampling Summary reports. The Summary of Hi-Volume Results tables from those reports issued for periods during performance of work on the RA are included in **Appendix D.1**. Analytical results showed levels of TSP, PM10, and metals below the action levels.

TRS Sampling

The ambient TRS sampling was conducted using a Photovac 10S Plus portable gas chromatograph capable of measuring odorous sulfur compounds in the low part per billion range. Ambient TRS sampling was conducted twice a week from the beginning of the sampling program up until December 1992. After that, the sampling frequency was reduced to once every six days.

Eastmount Environmental prepared Ambient Air Sampling Summary reports. The Summary of Ambient TRS Results tables from those reports issued for periods during performance of work on the RA are included in **Appendix D.1**. The majority of TRS results were non-detects. Hydrogen sulfide was detected on a few occasions; however, there were no exceedances of the 47 ppb action level.

Surface Water Monitoring

CWM was also required to monitor surface water during remedial activities. According to the Site Surface Water Monitoring Plan (RAWP, Section 5.2), the following Ambient Water Quality Control (AWQC) concentrations were used as the response action levels for the Industri-Plex Site:

- AWQC chronic concentration for arsenic = 0.190 milligrams per liter (mg/L);
- AWQC chronic concentration for chromium = 0.210 mg/L; and
- AWQC acute concentration for lead = 0.082 mg/L.

The above-tabulated AWQC limits correspond to a hardness of 100 parts per million (ppm). Water hardness values on-Site indicated moderately hard to very hard conditions (EPA, 1986). Historical background surface water data collected from surface water drainways periodically contained lead concentrations of 0.025 mg/L. Since these background levels routinely exceeded the threshold value of the AWQC chronic concentration for lead, the AWQC acute concentration was approved on June 8, 1994 as the response action level by MassDEP and EPA.

Surface water sampling was conducted to meet the project specifications and the RAWP requirements. The surface water controls established by EPA and included in the Contractor's RAWP required the following procedures:

- Each work day, field measurements were conducted at various stations (whenever there was flow) for turbidity, dissolved oxygen, temperature, specific conductivity, and pH. The sample from each station with the highest turbidity during the week was submitted for laboratory analyses of total and dissolved arsenic, lead, and chromium, total suspended solids (TSS), and hardness. Any sample with a turbidity greater than or equal to 85 nephelometric turbidity units (NTU) was also submitted for the same laboratory analyses.
- Additional sampling was conducted if a storm and/or a construction event caused the turbidity to rise above 85 NTU at the monitoring stations. The samples were analyzed for total and dissolved metals (arsenic, chromium, and lead), TSS, and hardness. Field measurements for turbidity, dissolved oxygen, temperature, specific conductivity, and pH were conducted at the time of sampling.

HMM conducted surface water quality sampling as a subcontractor to CWM. Test results indicate that the surface water quality remained below the response action thresholds with the exception of exceedances as listed in **Appendix D.2**. Specific reasons and mitigating actions for each exceedance are described in the Quarterly Reports of 1993-1995. Generally, the Agencies were notified and the mitigating actions were performed to the satisfaction of the Agencies.

5.3 Decontamination

CWM was required to decontaminate all equipment that came in contact with contaminated soils, sediments, and sludges during the work. Water used during the pressure washing was collected and treated at the on-Site storage areas. The decontamination was performed in accordance with the specifications and the project work plans. Water generated from decontamination activities was stored in a Modu-tank on the east side (across the MBTA rail lines) of the Site. The water was treated and properly disposed of on-Site as approved by the Agencies.

Personnel entering work areas (exclusion zones) during the RA, wore protective equipment as specified by CWM's Health and Safety Plan (HASP). The HASP also specified personal decontamination procedures. All personnel leaving work areas were required to properly clean or dispose of all protective equipment, small tools and instruments.

5.4 Facility Documentation for Off-Site Disposal

Prior to disposing of any materials off-Site during the RA, EPA was to determine if the proposed facilities were of "acceptable status" and could receive materials from the Site. Only non-hazardous vegetation (cleared/cut above ground surface) was disposed off-Site during the RA. During the work, as previously discussed, wastewater from decontamination activities was stored on the east side of the Site and treated prior to disposal.

All grubbed vegetation (containing soil), and contaminated soil, sediments, and sludges excavated from the Site were consolidated in other areas of the Site in accordance with the RDAP. All contaminated materials excavated from the Site were placed on the hide piles that were covered as part of the approved RA. However, prior to placement on the hide piles, saturated sediments and sludges were dried over large areas east of the MBTA rail lines on the Site within the remedial cover area.

6.0 SOURCE AND CONFORMANCE TESTING

Testing performed for the Remedial Trust, such as testing of soil and soil products and geosynthetics, is described in Sections 6.1 and 6.2, respectively. The testing methods according to the specifications are summarized in **Table 2** [i.e., Golder's Quality Assurance Procedure Plan (QAPP) Table 1-1]. Abbreviations used in the supporting documentation found in the appendices are summarized in **Table 3**.

6.1 Soil and Soil Products

6.1.1 Compacted Fill

The majority of compacted fill materials were derived from on-Site grubbing and dredging operations. Compacted fills were used as stabilizing fill to flatten hide pile slopes and re-grade low relief areas to promote drainage. A portion of rock and concrete demolition debris generated by crushing and screening operations was also used to a limited degree as compacted fill material. The remaining compacted fill was imported from off-Site borrow areas. Most of the off-Site fill was composed of silty sand from a quarry in Hubbardston, Massachusetts and glacial till from a borrow pit on Deer Island, Boston Harbor, Massachusetts. Compacted fill tests included grain size distribution and primarily Standard Proctor tests with some Modified Proctor tests as needed.

6.1.2 Cover Soil

All cover soil used on-Site was from off-Site sources. Cover soil placed on slopes flatter than 8 horizontal to 1 vertical (8H:1V) was typically a granular silt from a glacial till deposit on Deer Island. Cover soil placed on slopes steeper than 8H:1V and some slopes flatter than 8H:1V was a silty sand from a quarry in Hubbardston. Cover soil tests included grain size distribution, Standard and Modified proctor densities, interface friction, and Atterburg Limits. Results of the testing are provided in **Appendix F**. Analytical testing was performed on Deer Island cover soil materials to verify the levels of potential contaminants. All soil materials tested and placed on-Site met the clean soil thresholds set up by EPA, after consultation with MassDEP, or were otherwise approved by a variance in accordance with EPA in consultation with MassDEP criteria. EPA in consultation with MassDEP clean soil threshold criteria for cover soil used at the Site are summarized in **Table 1**. Analytical test results are provided in **Appendix F.1**.

6.1.3 Topsoil

According to the Consent Decree, topsoil must be capable of supporting vegetation that minimizes both erosion and continued maintenance. Topsoil used for the cover in upland areas and as a wetland vegetative cover soil came from several off-Site sources. Such source locations were from the following Massachusetts towns: Andover, Reading, Salem, and Tewksbury. Other topsoils were sourced from the following New Hampshire towns: Nashua, New Boston, and Manchester. Each source was tested for grain size distributions, organic content, and soil fertility or Baker Soil test. Results of testing are provided in **Appendix F.2.3**. Where the topsoil did not meet some criteria, but would be capable of meeting the Consent Decree requirement for being capable of supporting vegetation, a variance was requested and received from EPA, after consultation with MassDEP.

6.1.4 Subangular Stone

There were several varieties of subangular stone required by the 100% Design Report. Each of the subangular stone materials was a product of off-Site crusher/screener operations from PJ Keating Company of Lunenburg, Massachusetts or Bardon Trimount Inc. of Burlington, Massachusetts. The products required for the RA included American Association of State Highway and Transportation Officials (AASHTO) No. 8, the stone used in the gas collection layer material; AASHTO No. 57, a variety of stone used for bedding and armoring purposes; and both AASHTO 2 and 67, stone materials used in sediment filter construction. Testing of these stone materials consisted of the following: grain size, permeability, and carbonate content. Testing was performed on a per source basis unless the Remedial Trust requested additional testing. Test results are provided in **Appendix F.2.2**. On the MBTA property, at the request of the MBTA, AREA No. 4 stone (ballast) was substituted for AASHTO No. 57 stone for gravel engineered permeable cover.

6.1.5 Stone Riprap

Two average sizes of stone riprap (d50 = 6-inch and d50 = 3-inch by weight) were required by the 100% Design Report. Each of the riprap stone materials was produced at off-Site crusher/screener operations owned by PJ Keating Company of Lunenburg, Massachusetts or Bardon Trimount Inc. of Burlington, Massachusetts. Both types of stone riprap were used as gravel/cobble lining for remediated drainways and hide pile toe drain construction. The 6-inch riprap was also used in permanent erosion control features and as gabion backfill material.

Testing of the riprap included a test for abrasion, freeze-thaw susceptibility, and specific gravity. Gradation tests were also reviewed. Stone riprap materials were tested once per source area unless the Remedial Trust requested additional testing. The stone riprap test results are presented in **Appendix F.2.2**.

6.1.6 Subbase

Road Structural Fill as specified in Section 02223 was used as subbase in the Remedial Action. Tests for the subbase material included gradation and compaction. All subbase materials were supplied by an off-Site quarry. Test results are provided in **Appendix F.2.1**.

6.2 Geosynthetics

6.2.1 Geotextile

6.2.1.1 Materials

Geotextile materials were supplied by the following three manufacturers: Nicolon/Mirafi, Polyfelt Americas Inc., and Synthetic Industries. Nicolon/Mirafi provided 6-ounce (oz), 10-oz and 16-oz geotextile, Polyfelt Americas Inc. provided 6-oz and 16-oz geotextile and Synthetic Industries provided 16-oz geotextile. All fabrics are permeable, non-woven, needle-punched monofilament and allow percolation. The geotextile was used in the cover to primarily separate the contaminated soil from the clean cover soil (Golder, 1989). The geotextile also precludes upward migration of contaminated material by frost heave effects; provides a drainage capillary break layer at the base of the cover on slopes to prevent sloughing during thaws; and provides further means of reducing the chance of incidental contact through land use.

6.2.1.2 Quality Control Testing

The manufacturers of the geotextile material provided Quality Control certificates for the installed 6-, 10-, and 16-oz materials. Copies of the Quality Control Certificates are presented in **Appendix H.1.2**. As material was delivered to the Site, Golder reviewed the Quality Control Certificates for conformance with the 100% Design through the submittal process.

6.2.1.3 Quality Assurance Testing

Rolls of 6-, 10- and 16-oz geotextile were tested for conformance to the 100% Design Report specifications. Conformance testing was performed by Golder Construction Service's Geosynthetic Laboratory (Golder Construction's Geosynthetic Laboratory) located in Atlanta, Georgia. Test results are provided in **Appendix H.1.3**. Before individual rolls of geotextile were deployed on-Site, Golder reviewed the test results for conformance with the project specifications.

6.2.2 Geomembrane

6.2.2.1 Material

Rolls of 60 mil HDPE geomembrane liner were supplied by National Seal Company and deployed over the East Hide Pile.

6.2.2.2 Quality Control Testing

The manufacturer of the geomembrane material provided Quality Control Certificates for each roll of 60 mil HDPE geomembrane liner. These certificates are provided in **Appendix H.2.2**. As submitted by the contractor, Golder reviewed the Quality Control Certificates for conformance with the project specifications before the material was used on-Site. Based on the Quality Control Certificates, the geomembrane liner used was in conformance with the 100% Design Report specifications.

6.2.2.3 Quality Assurance Testing

Rolls of HDPE geomembrane liner were sampled and tested for conformance with the 100% Design Report specifications. The conformance testing frequency exceeded the project specifications requirement of one conformance test for every 100,000 square feet of geomembrane liner delivered to the Site. All of the geomembrane liner conformance test samples passed the minimum project specification requirements. All of the conformance samples were tested by Golder Construction's Geosynthetic Laboratory. These test results are provided in **Appendix H.2.4**.

6.2.3 Geocomposite

6.2.3.1 Material

Rolls of TN3002CN geocomposite, geonet with a factory bonded geotextile on both sides, were supplied by Fluid Systems and delivered to the Site. The geocomposite was used for supplementary drainage in the permeable cover on the West Hide Pile where slopes were 25 percent or steeper and on the East Hide Pile over geomembrane

6.2.3.2 Quality Control Testing

The manufacturer of the geocomposite material provided Quality Control Certificates. Golder initially reviewed the Quality Control Certificates for conformance with the 100% Design Report specifications and determined the material did not meet the project specifications. Consequently, the Contractor provided a letter of evaluation which concluded that the geocomposite was capable of providing drainage per the design. This letter is provided in **Appendix H.3.2**. Golder also evaluated the drainage capability of the material and confirmed the geocomposite would provide the drainage capacity of the design storm. The material was accepted for use.

6.2.3.3 Quality Assurance Testing

Rolls of geocomposite were sampled and tested for conformance with the project specifications; conformance samples were tested by Golder Construction's Geosynthetic Laboratory. Transmissivity tests were performed by TRI/Environmental Inc., Austin, Texas. Test results are provided in **Appendix H.3.3**.

6.2.4 Geogrid

6.2.4.1 Material

Rolls of UX1400 uniaxial geogrid were supplied by Tensor Inc. and delivered to the Site for placement on the West Hide Pile slopes. These geogrid materials were used to reinforce the cover layer only where the slope of the cover was steeper than 33 percent.

6.2.4.2 Quality Control Testing

The manufacturer of the geogrid materials provided Quality Control Certificates. Through submittals, Golder reviewed the Quality Control Certificates for conformance with the 100% Design Report specifications. Copies of the Quality Control Certificates are presented in **Appendix H.4.2**. Based on the Quality Control Certificates, the geogrid used was in conformance with the 100% Design Report specifications.

6.2.4.3 Quality Assurance Testing

Rolls of geogrid were sampled and tested for conformance with the 100% Design Report specifications. All the conformance tests of the geogrid met the minimum 100% Design Report specification requirements and were tested by Golder Construction's Geosynthetic Laboratory. Test results are provided in **Appendix H.4.3**.

6.2.5 Interface Friction

A key design concern for the cover is its internal stability on slopes. The 100% Design Report required testing of the interface friction between the cover soil and the geotextile. Representative tests of cover soil with geotextile or geocomposite materials were required to verify the design friction angle of 26 degrees. The Contractor presented a testing program and provided initial source test results of the interface friction. Through submittals, Golder reviewed the source test results and determined that, based on the Contractor's certification of source representative testing, the cover soil with geotextile or geocomposite met the 100% Design Report specification requirements. Additional testing was performed by Golder on representative samples of cover soil and geotextile or geocomposite materials for interface friction from the East and West Hide Piles. Conformance testing of interface friction was performed on a 12-inch by 12-inch direct shear apparatus in the Golder testing laboratory in Calgary, Canada. All conformance test results showed the cover soil with geotextile or geocomposite met the 100% Design Report specifications. Test results are provided in **Appendix H.6**.

6.3 Asphalt Cover Materials

6.3.1 Bituminous Materials

Bituminous materials were used to construct asphalt covers within the subject property. Four inches of asphalt binding course and two inches of asphalt wearing surface were placed and compacted above the six-inch granular subbase layer of the asphalt cover.

Material Requirements

Two types of bituminous concrete, a binder course and a surface or wearing course, were specified by the design specifications. The specifications required that the mix for binder and surface course conform to the requirements of the Massachusetts Department of Public Works Specifications (MDPW). The following table summarizes the State mix requirements according to the Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges:

Sieve Size	State Binder (% by weight passing)	State Top (% by weight passing)
1-inch	100	*
3/4-inch	80-100	*
5/8-inch	*	100
1/2-inch	55-75	95-100
3/8-inch	*	80-100
#4	28-50	50-76
#8	20-38	37-54
#16	*	26-40
*No limit/value established for the specific parameter.		

Sources

Midway Paving of Chelmsford, MA performed the paving work on the subject property. Bardon Trimount supplied the asphalt materials, and Middlesex Materials supplied the aggregate materials. The asphalt was mixed at Massachusetts Bituminous in Chelmsford, MA.

Testing Requirements

The specifications required testing of the pavement materials. Standard Marshall testing, which including testing for stability, flow, and density, was conducted at the bituminous plant prior to Site delivery.

The asphalt binder and top course materials were required to meet the MDPW Standard Specifications. Field compaction testing and asphalt covering was performed to determine if the materials were placed in accordance with the MDPW Standard Specifications.

Conclusions

Bituminous plant inspection reports (including material test results) and field compaction and coring results for the subject property are included in **Appendix G**. Bituminous plant inspection reports provided in **Appendix G** show the material delivered met the MDPW Standard Specifications requirements. Field quality assurance testing was performed during installation of the asphalt. PSI performed nuclear density testing, checked lift thickness, and asphalt temperatures. Asphalt testing performed during construction and cores cut at a later date had both thickness and in-place density that did not meet design specifications. These discrepancies were accepted by the Remedial Trust because repair would be more damaging than accepting the pavement as-is. These discrepancies are located on the following parcels:

- Stephen and Adeline Dagata , Tax Map Lot 9-2-7;
- PX Realty Trust Parcel 1, Tax Map Lot 9-1-7;
- PX Realty Trust Parcel 2, Tax Map Lot 9-1-8;
- WJP Realty Trust, Tax Map Lot 9-7-4; and
- Aero Realty Trust Parcel 2, Tax Map Lot 9-2-4.

These discrepancies are addressed in CAR-012, CAR-013, CAR-14, CAR-15, CAR-056, CAR-078, and CAR-79.

6.3.2 Aggregate

In asphalt cover systems, clean, road-grade structural fill (granular subbase) was placed and compacted above the base geotextile separation layer.

Material Requirements

Per Specification Section 02223 – Backfill and Fill, the granular subbase was clean material from an off-Site source approved by the Remedial Trust Representative. The granular subbase also met the following gradation specifications:

Sieve Designation	3 in	3/4 in.	No. 10	No. 50	No. 200
Percent Passing	90-100	50-90	40-80	20-60	5-15

Sources

All granular subbase used on the subject property was supplied by two quarries, Bardon Trimount of Swampscott, MA and PJ Keating of Lunenburg, MA.

Testing Requirements

Geotechnical testing requirements for the granular subbase are specified in Section 02223 – Backfill and Fill and include grain size (ASTM D422) and standard proctor (ASTM D698) methods. Both the Bardon Trimount and PJ Keating sources were virgin or native quarry operations. Therefore, analytical testing was not required to verify that the material was clean.

Conclusions

The geotechnical test results for the granular subbase are included in **Appendix F**. While the gradation test results show that the material was not always completely in accordance with gradation requirements on the #10 and #50 sieves, Golder determined the material met the intent of the design and the material was accepted by the on-Site Resident Engineer.

7.0 REMEDY CONSTRUCTION

7.1 Construction Sequence

7.1.1 Decommissioning

7.1.1.1 Decommissioning Wells

Various existing wells and piezometers were identified in the 100% Design Report requiring decommissioning or abandonment prior to construction of the cover on the Site. The 100% Design Report identified wells and piezometers to be decommissioned; however, during grubbing operations for the Remedial Action, additional unidentified wells (UID) were located. The Contractor with a subcontractor (Maher) proposed and submitted for review decommissioning methods for each well in accordance with the 100% Design Report specifications. Maher used several drilling rigs during the decommissioning work, including all-terrain vehicles for remote locations, and Barber dual rotary drill for over drilling wells. A Smeal pump hoist was used to perforate Poly-vinyl chloride (PVC) pipe left in place. All cuttings were retained in water tight roll-offs and later deposited on the west side of the East Central Hide Pile. PVC pipe removed during decommissioning was disposed of off-Site after decontamination. From December 1992 until April 1993, the majority of the wells were decommissioned or abandoned in accordance with the 100% Design Report specifications. 73 monitoring wells, five well points, 14 piezometers, 15 boreholes, and 36 previously unidentified wells, located on the Site were decommissioned or abandoned in accordance with the 100% Design Report. A list of the decommissioned wells and copies of the driller's decommissioning logs are provided in **Appendix E**. Locations of the decommissioned wells are shown on the record drawings (Attachment 1).

After reviewing the contractor's well decommissioning reports, Roux Associates confirmed that well decommissioning on the Site was substantially compliant with the 100% Design Report and the procedures outlined in Section 4.6 of the January 2001 Standard Reference for Monitoring Wells set forth by MassDEP. Wells were over drilled, pulled, or grouted in place with a grouting mixture of 95% cement and 5% bentonite. Wells were grouted to appropriate depths and plugged with concrete after the time requirement set forth by the standard.

7.1.1.2 Decommissioning Utilities and Structures

The 100% Design Report identified features that required decommissioning or abandonment prior to construction of the cover for the Remedial Action. Other abandoned below grade features that were discovered during construction of the cover were either removed to a depth 2 feet below the placement of the permeable cover or cleaned and backfilled with clean concrete. These features were left in place without any demolition or decommissioning if they did not otherwise impair the long-term effectiveness of the remedy. The general majority of the structure decommissioning occurred during construction of the RTC. A more detailed illustration of this decommissioning can be found in the “Final Report on RTC Cover Certification” dated April 1998 and prepared by Golder. Further information regarding structure decommissioning can be found in the property-specific Final Cover Certification Reports.

7.1.2 Soil Remedy

7.1.2.1 Subgrade and Drainage

Existing vegetation was cleared and root matter grubbed to a minimum depth of one foot prior to placement of the permeable cover in areas other than the South Hide Pile. No herbicides were employed to control re-establishment of vegetative growth. Tree roots were grubbed to a depth of 2 feet. In areas of the hide piles, all existing vegetation was cleared by means of back blading with a dozer, and brush or tree roots were cut to ground surface in order to minimize cutting into the hide pile. Woody material from above ground, roots and other vegetation were chipped and stockpiled for later placement as fill under the permeable cover. Rocks and concrete debris grubbed from the surface were crushed on-Site in order to comply with the fill material specifications. Reinforcing steel was removed from the concrete during the crushing operations and stockpiled for off-Site disposal.

The cover area in the vicinity of bedrock outcrops or exposed concrete structures was grubbed of vegetation and cleaned in accordance with recommendations of the Site Health and Safety Officer and documented by the Contractor. The surrounding soil cover was extended up to the outcrop or structure.

Material excavated on-Site was the primary source of fill to regrade the slopes of the hide pile or regrade flat areas to provide positive drainage. A granular material has less than 12% by weight passing the #200 sieve. Materials placed to flatten the South Hide Pile were from on-Site sources but were not granular. On-Site soils not meeting the granular criteria were placed as fill in permeable cover areas of the Site flatter than 8H:1V.

Existing subgrade soils were proof rolled prior to placing the cover and fill materials were compacted and tested. The final prepared grade was rolled with a 10-ton smooth wheel compactor or in small areas compacted with a hand operated plate vibratory compactor. Where positive drainage was called for in the 100% Design Report plans, such drainage was achieved in the finish grade of the cover. Throughout construction, erosion and sedimentation measures were generally utilized and maintained in accordance with the 100% Design Report specifications to control soil loss. Any deficiencies in the erosion and sedimentation measures were corrected in accordance with EPA in consultation with MassDEP guidelines.

7.1.2.2 Geosynthetics

After proof rolling, the prepared subgrade was inspected and any protruding debris or roots greater than ½-inch in diameter were manually removed prior to placing geosynthetics. After geosynthetics were placed, filling was performed to reach final elevations. On the east hide pile the gas venting layer was installed prior to the installation of the geosynthetic layers of the cover.

A 6-oz and 16-oz per square yard non-woven geotextile were used in permeable cover (other than on the East and West Hide Piles) where slopes were less than and more than 25 percent respectively.

A 16-oz per square yard non-woven geotextile was used in the East and West Hide Pile permeable cover where slopes were less than 25 percent. The TX3002CN geocomposite was used in the East and West Hide Pile permeable cover where slopes were steeper than 25 percent and the UX1400 geogrid was added over the geocomposite where slopes exceeded 33 percent. The geocomposite drain material extended to an elevation approximately 10 feet above the toe of the hide pile slopes to intercept any seepage from potential groundwater mounding within the hide pile.

A 10-oz. per square yard non-woven geotextile, 60-mil textured HDPE geomembrane, and geocomposite drainage layer were installed above the gas venting layer in the East Hide Pile engineered permeable cover. The 8-inch diameter perforated gas collection piping system was also wrapped in 10-oz. per square yard non-woven geotextile.

The geotextile materials were sewn together using white nylon thread for dark fabric and black thread for white fabric. Geocomposite was joined at the net with nylon cable ties and then sewn or thermal bonded with another piece of geotextile to minimize cover soil infiltration into the net.

The geotextile seam was initially placed with a minimum slack along the seam to protect it and allow for movement in the geotextile during placement of cover soil. This procedure was primarily practiced in the developed areas of the Site with little topographic relief. Subsequent reviews of the procedure and the 100% Design Report concluded the extra slack was unnecessary and the procedure was discontinued for the remainder of the Remedial Action.

The geomembrane was seamed by welding and the seams were subjected to quality control and quality assurance testing as described in Sections 6.2.2.2, 6.2.2.3, and 9.5.

7.1.2.3 Cover Soil

Cover soils placed over the geotextile on slopes greater than 8H:1V were granular materials from off-Site sources that had an inherently low potential to clog the geotextile. For slopes flatter than 8H:1V, the cover soil from off-Site sources could contain more than 12 percent by weight passing the #200 sieve. In all areas where the remediated slope was steeper than 33 percent, a geogrid reinforcement layer was included at the base of the cover soil immediately above the geosynthetic layer. The cover soil was placed in a manner that minimized imposed stresses on the underlying geosynthetics by using low ground pressure earth moving equipment and maintaining a minimum thickness of 12 inches of soil between the rubber tire equipment and the geosynthetic. Cover soil placed in unpaved areas with permeable cover was nominally compacted by the action of the placing equipment only.

Other cover sections used in limited areas or for access roads were comprised of various combinations of cover soil and dense graded aggregate subbase or riprap. Each modified section of cover is designed to be a minimum of 16 inches in accordance with the specifications of the 100% Design Report. The types and locations of these modified sections are included in the record drawing documentation, **Attachment 1**.

Minimum thicknesses of cover soil are detailed in Section 02242 of the 100% Design Report. Generally, the permeable cover consists of 12 inches of select soil fill and 4 inches of topsoil. Generally, the drainage swale impermeable cover consists of 16 inches of riprap. The tolerance, in thickness is -0.0 feet and +0.3 feet. Based upon survey data collected both at the time of construction, as well as post construction data collected, the vast majority of the Site meets the design thickness within the tolerances.

Any isolated areas identified by multiple post construction survey data points to be below the acceptable tolerances, were corrected by the placement of additional cover fill to meet the required thickness. This repair of cover fill was performed during the summer of 1999 by Maverick. Additionally, several areas of the site where isolated points remained with documented cover thicknesses less than the design required thicknesses were inspected by Roux Associates in 2008.

Based on analysis of the of the relevant survey data points located on the Koster Revocable Trust Property (Parcel 1) (Tax Map 4-7-9), the minimum thickness of cover soil specified in Section 02242 of the 100% Design Report was not met at one location adjacent to the southern loading dock because doing so would have created an unsafe condition. Achieving the minimum thickness in that location would have required the contractor to undermine the structural integrity of the building.

The minimum thickness of cover soil specified in Section 02242 of the 100% Design Report was not met at one location (point 27291) on the RRSN Property (Tax Map 5-1-3). This location was surveyed following completion of the RTC Cover, and did not meet minimum thickness requirements. According to Maverick, additional fill was placed to meet the 100% design requirements. However, this point was not re-surveyed following this remediation.

The minimum thickness of cover soil specified in Section 02242 of the 100% Design Report was not met at five locations (11173, 11174, 11177, 11178, and 11179) on the City of Woburn Property (Tax Map 10-1-17). Finished grade at each of these locations matches the finish grade specified in the 100% cover design. These locations were near the Type C transition from above grade engineered permeable cover to the wetland, which included a second vertical geotextile that separates the gravel transition material from the above grade cover soil. Because final grades match the design grades, Roux Associates believes that “subgrade elevation” identified by Meridian was actually the elevation of this separation geotextile, not the actual subgrade elevation, and that the cover thickness does meet design requirements at these locations. Therefore, Roux Associates has concluded that required cover thicknesses meet the requirements of the 100% design at all locations of this property.

The minimum thickness of cover soil specified in Section 02242 of the 100% Design Report was not met at three surveyed locations (19518, 19521, and 20582) on the Chestnut Hill Realty Trust Property (Tax Maps 10-1-9, 10-1-11, and 10-1-12). Location 20582 is located near the top of the bank on the eastern side of the created wetlands, where total cover thickness was 1.7-inches below design requirements. Each adjacent surveyed location meets or exceeds the 100% design requirements. Roux Associates has determined that this isolated discrepancy does not, therefore, jeopardize the integrity of the cap.

Locations 19518 and 19521 are located at the outfall of the former stone lined drainage channel that joined Wetlands 1C with the created wetlands on the Chestnut Hill property. During the RTC construction, the drainage channel was replaced with a culvert, and the outlet area was reconfigured. The reconstructed outfall is shown on the Record Drawings. Appendix M, M.9.1, for the Final Report on RTC Cover Certification, which was approved by EPA on April 28, 1998.

Roux Associates determined that the existing cap thickness met the design requirements within acceptable limits and did not jeopardize the integrity of the cover.

7.1.2.4 Topsoil and Vegetation

Topsoil was placed over the cover soil in 4-, 6- or 8-inch thicknesses as specified by the 100% Design Report. After placing the top soil, lime and fertilizer were applied to the topsoil by a York rake in larger areas and by a walk-behind drop-spreader for small areas. Seed was broadcast by the hydroseed method in all other areas using fertilizer mulch and seed according to the 100% Design Report, or approved variances.

7.1.3 Sediment Remedy

7.1.3.1 Wetland Sediments

The sediment remedy included the remediation of wetlands throughout the Site. The 100% Design Report indicated two remedy solutions for the remediation of wetlands. In sediment remedy areas where Arsenic, Lead and/or Chromium exceeded the established Consent Decree action levels and hide residues were found, a 16-inch thick permeable cap consisting of a 16 ounce nonwoven geotextile placed on the sediments, followed by a 12-inch soil cover with a 4-inch thick topsoil layer was placed over the sediments. In sediment remedy areas where Arsenic, Lead and/or Chromium exceeded the established Consent Decree action levels in absence of hide residues, the sediments were dredged to a depth of 16-inches and a 16-inch thick permeable cap consisting of 16-ounce nonwoven geotextile followed by 8-inches of gravel and 8-inches of topsoil were placed over the sediments. Information for remedial actions conducted at individual wetlands can be found in the property specific Final Cover Certification Reports.

7.1.3.2 Stream Sediments

The sediment remedy included remediation of streams throughout the Site. The 100% Design Report states that the streams on Site serve several functions as part of the remedy. These functions include the collection of stormwater from surrounding drainage areas, the conveyance of stormwater form upstream, and the storage of backwaters during a storm. The remedy for stream sediments was designed to satisfactorily perform all of the aforementioned functions. Additionally the following criteria were considered in the selection of the remedy:

- Ability to perform in accordance with their design objectives for a minimum of 30 years;
- Satisfactory performance under varying groundwater conditions and to prevent sediment transport via groundwater seepage toward the stream;

- Prevention of surface water from contacting sediments and, possibly, transporting sediments downstream;
- Minimization of storage capacity losses;
- Satisfactory performance under variable weather conditions;
- Maintenance of discharge capacity so that peak discharges can be conveyed without increasing flood potential;
- Minimization of excavation of hide residues, and;
- Continued ability to collect runoff from the surrounding drainage areas.

The 100% Design Report offered three remedy choices for application in stream sediment scenarios. The first stream sediment remedy, for streams containing Arsenic, Lead and/or Chromium at or above Consent Decree action levels, in the absence of hide residues, consisted of a gravel/cobble cap to be placed after dredging the sediments. A minimum of 16 inches of sediments was dredged followed by the placement of a 16 ounce nonwoven geotextile and a 16 inch gravel/cobble with a d_{50} of 3-inches. The second stream sediment remedy, for streams containing Arsenic, Lead and/or Chromium at or above Consent Decree action levels and hide residues, utilized the same cover with the minimum amount of dredging consistent with maintaining storm flow capacity. A third stream sediment remedy consisted of culvertization. The culvertization was selected only for the portion of the Western Branch of the Aberjona River adjacent to the East Central Hide Pile, where regarding the slope of the hide pile, for stabilization purposes, does not allow other solutions. Information for remedial actions conducted at individual streams can be found in the property specific Final Cover Certification Reports.

7.1.4 Air Remedy

The air remedy consists of a cover constructed in accordance with Section 7.1.2. Gas collection and treatment are described below.

7.1.4.1 Gas Collection

The gas collection system is incorporated in the impermeable cover for the East Hide Pile. The system consists of a 12-inch thick layer of gravel with a network of ten 8-inch diameter perforated fiberglass collection pipes radiating bilaterally from a central 8-inch diameter fiberglass manifold pipe. Collection pipe to manifold junctions are located in vaults along the manifold, and are controlled by pneumatically controlled butterfly valves.

The gas collection system was installed as specified in the 100% design report. Design changes include an increase in the gas collection pipe size, layout of the collection pipe, and vault locations. As-built conditions and design changes are documented in Attachment 1, Section 8.3, Appendix C, and Appendix K.

7.1.4.2 Gas Treatment

A thermal oxidizer unit (TOU), designed and constructed by NAO, Inc., was installed at the East Hide Pile. The TOU system includes a direct fired flare, gas pressure boost blowers, control system. A building (the TOU building) was constructed to the northeast of the East Hide Pile to house the TOU components and provide both storage and office space.

The TOU flare and boost blowers were installed outside along the north wall of the TOU building. TOU system controls, and continuous emissions monitoring system (CEMS) were installed inside the TOU building. Initially, the TOU was design to operate using natural gas as the supplemental fuel, however, in October 1994 the system was redesigned to operate using propane and propane storage tanks were installed on a concrete pad located to the east of the TOU building. In February of 2001 the TOU was modified back to the original configuration using natural gas as the supplemental fuel. Record drawings of the TOU are provided in Appendix K.

The CEMS was initially designed by Anarad, but this system was not installed because of conflicts identified during design review between the system measurement method and the compounds likely to be emitted from the TOU stack. A second CEMS was designed by and installed Datatest. However, subsequent alterations to the TOU operational cycle resulted in the formation of condensation in the stack probe and required further alteration of the CEMS. The CEMS was modified to accommodate the revised operational cycle, and became fully operational in February, 1998. The CEMS is a Thermo Environmental Instruments (TEI) Model 200 gas analyzer. The analyzer is integrated with the TOU PC-base control system which performs data logging.

A Compliance Assessment of the TOU system was performed by TRC Environmental Corporation, the result of this assessment are presented in the Draft Final Report “Compliance Emissions Testing of a Thermal Oxidizing Unit at the Industri-Plex Site Remedial Trust in Woburn, Massachusetts” dated May 2003. This report is provided in Appendix K. Based on the results of this report, the TOU was operating as required by the 100% Design Report.

8.0 DESIGN CHANGES

Section 8.0 describes design changes associated with the Alternative Cover Design Report (Golder, 1989), approved by EPA on September 11, 1989, and the RTC Cover Certification Report (VHB/Golder, 1996), approved by EPA on October 1, 1996.

8.1 Change Management

During the Remedial Action from 1992 to 1994 for the Site, changes were managed through the Remedial Trust. At the start of 1995, the Remedial Trust and Contractor agreed to a new scope and cost contract for the remaining remedial work. The Construction Management contractor, Golder Construction, performed change management during 1995 as an agent for the Remedial Trust.

Managing changes for the Remedial Action primarily included changing the agreed upon scope of work or technical details of the 100% Design Report. Requirements identified in the Consent Decree were not changed unless approved by EPA, after consultation with MassDEP. Changes could be initiated from any of the following: EPA or MassDEP, the Contractor, the Remedial Trust or Golder as the designer, and later, Golder Construction in the role of Construction Managers.

Changes were divided into two categories, design specification changes and administrative, cost and schedule changes. Design specification changes were usually technical in nature and involved specific changes to the details of the specifications and plans presented in the 100% Design Report. Generally these changes were minor and EPA, after consultation with MassDEP, initially wanted only to review significant changes. Design changes were originally documented as design/specification change requests (DSCR). Impacts to cost and schedule were handled by another system administered by the Remedial Trust.

Early in 1994, the Contractor made several management revisions including a new method for managing changes. The Contractor introduced a change management system that included Variance Requests (VRs), Change Request Authorizations (CRAs), Corrective Action Requests (CARs), and Requests for Information (RFIs), procedures that subsequently were accepted by the Remedial Trust. The DSCR system was phased out by mid 1994 with the introduction of this change management system. A summary table listing all design changes pertaining to this Cover Certification Report and copies of all the associated design change forms are included in **ROUX ASSOCIATES, INC.**

Appendix C. A table listing the design changes, change status, and applicable properties for each change is presented as **Table 4**.

8.2 Site Wide Design Changes

A series of DSCRs and CARs were adopted for Site wide application.

The Site wide design changes listed below were approved by the resident design engineer, project manager, EPA and/or MassDEP. The design changes generally related to grubbing, geotextile selection, geotextile installation, fill materials selection, and fill materials sampling. Several design changes applied to design details that required revision to match the 100% Design Report. The approved design changes included:

- DSCR-001
- DSCR-002
- DSCR-003
- DSCR-023
- DSCR-027
- DSCR-030
- DSCR-056
- DSCR-069
- VR-008
- VR-031
- VR-056
- VR-064
- VR-067
- VR-074
- VR-077
- VR-079
- VR-090

Additional Site wide design changes were identified as requiring further review in order to verify compliance with the 100% Design Specifications. These design changes included:

- CAR-053 involved a request for resampling of Deer Island Stockpile materials due to incorrect initial sampling procedures. The stockpile was resampled on March 30, 1994 and approved by the Agencies on April 28, 1994. The CAR was not signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover.
- CAR-071 involved a request for resampling of soil Stockpiles 5 and 6. Hold times for volatiles in the soils were exceeded. The Remedial Trust decided to accept data for Stockpile 5, but requested Stockpile 6 be resampled. Stockpile 6 was resampled on March 30, 1994, and test results were approved by the Agencies on April 28, 1994. The CAR was not signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover.

8.3 Property-Specific Design Changes

A series of DSCRs, CARs, VRs, and CRAs were adopted for application on the subject properties. A summary table listing all design changes is provided in **Appendix C**. A table listing the design changes, change status, and applicable properties for each change is presented as **Table 4**.

The property-specific design changes listed below were approved by the resident design engineer, project manager, EPA and/or MassDEP. The design changes generally related to geosynthetic materials, materials placement, grading, and wetland specifications. The approved design changes included:

- | | | |
|------------|------------|------------|
| • DSCR-004 | • DSCR-028 | • DSCR-051 |
| • DSCR-005 | • DSCR-029 | • DSCR-052 |
| • DSCR-006 | • DSCR-031 | • DSCR-053 |
| • DSCR-007 | • DSCR-032 | • DSCR-054 |
| • DSCR-008 | • DSCR-033 | • DSCR-055 |
| • DSCR-009 | • DSCR-034 | • DSCR-057 |
| • DSCR-010 | • DSCR-035 | • DSCR-058 |
| • DSCR-011 | • DSCR-036 | • DSCR-059 |
| • DSCR-012 | • DSCR-037 | • DSCR-060 |
| • DSCR-013 | • DSCR-038 | • DSCR-061 |
| • DSCR-014 | • DSCR-039 | • DSCR-062 |
| • DSCR-015 | • DSCR-040 | • DSCR-064 |
| • DSCR-016 | • DSCR-041 | • DSCR-065 |
| • DSCR-017 | • DSCR-042 | • DSCR-066 |
| • DSCR-018 | • DSCR-043 | • DSCR-067 |
| • DSCR-019 | • DSCR-044 | • DSCR-068 |
| • DSCR-020 | • DSCR-045 | • DSCR-070 |
| • DSCR-021 | • DSCR-046 | • DSCR-071 |
| • DSCR-022 | • DSCR-047 | • DSCR-072 |
| • DSCR-024 | • DSCR-048 | • DSCR-073 |
| • DSCR-025 | • DSCR-049 | • DSCR-074 |
| • DSCR-026 | • DSCR-050 | • DSCR-076 |

- DSCR-077
- DSCR-078
- DSCR-079
- CAR-001
- CAR-002
- CAR-003
- CAR-004
- CAR-005
- CAR-006
- CAR-007
- CAR-008
- CAR-009
- CAR-010
- CAR-011
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- VR-026
- VR-027
- VR-028

- | | | |
|----------|----------|-----------|
| • VR-030 | • VR-054 | • VR-082 |
| • VR-032 | • VR-055 | • VR-083 |
| • VR-033 | • VR-057 | • VR-084 |
| • VR-035 | • VR-058 | • VR-085 |
| • VR-037 | • VR-058 | • VR-086 |
| • VR-038 | • VR-062 | • VR-087 |
| • VR-040 | • VR-065 | • VR-088 |
| • VR-041 | • VR-066 | • VR-089 |
| • VR-042 | • VR-068 | • VR-091 |
| • VR-043 | • VR-069 | • VR-092 |
| • VR-044 | • VR-070 | • CRA-001 |
| • VR-045 | • VR-071 | • CRA-003 |
| • VR-046 | • VR-072 | • CRA-007 |
| • VR-047 | • VR-073 | • CRA-008 |
| • VR-049 | • VR-075 | • CRA-010 |
| • VR-050 | • VR-076 | • CRA-011 |
| • VR-051 | • VR-078 | • CRA-012 |
| • VR-052 | • VR-080 | • CRA-014 |
| • VR-053 | • VR-081 | • CRA-020 |

Of the property-specific design changes, the following were identified as requiring further review in order to verify compliance with the 100% Design Specifications:

- DSCR-075 was a Remedial Trust-initiated change request. According to available records BECO wanted to install the same stone on the roads as used on the rest of the ROW, effectively deleting the road from the site. The DSCR form could not be located; however the available records indicated that the Remedial Trust approved the change. The integrity of the cover would not be affected by altering the surface materials from asphalt to gravel
- VR-006 involved a request to use high density polyethylene (HDPE) pipe in place of fiberglass reinforced plastic (FRP) pipe in the gas collection layer of the East Hide Pile. The Remedial Trust modified the request to specify that the 0.4” slot opening be oriented at 120 degrees with one of the slots facing down on the gas collection stone. The modifications to this variance request were addressed in a subsequent variance—VR-007.

- VR-007 documented a change in the type of pipe used for gas collection from perforated pipe to machine slotted pipe. The VR was modified by the trust, requesting the gas collection blowers be equipped with inlet filters if recommended by the manufacturer. No additional documentation is available, and the blowers are not equipped with filters. Since the time of system installation the blowers have not failed as a result of particulate in the gas stream, Roux Associates has determined that filters were not necessary, and this VR properly was implemented.
- VR-011 involved a request for approval of an alternative wetlands seed mix. The Remedial Trust modified the variance and specified that the modified alternative seed mix be submitted for final review and approval. VR-011 Rev. was unable to be located, but appears, from available descriptions, to include the modified alternative seed mix specifications. Roux Associates researched the request further in the submittal records and found that an alternative wetlands seed mix was submitted to the Remedial Trust on September 20, 1994 and approved September 22, 1994. This date follows the date of VR-011, and thus, demonstrates the alternative wetlands seed mix was, in fact, submitted to and approved by the Remedial Trust.
- VR-017 involved a request for the Remedial Trust to revise the gradation and permeability specifications for the gas collection stone on the East Hide Pile, because some of the gradation and permeability tests results of stone stockpiled on-Site did not meet the specifications. The variance form indicates the Remedial Trust made an exception and accepted the stone that did not meet the gradation and permeability specifications, but did not revise the gas collection stone design specifications.
- VR-023 involved a request to include a vendor's regulator with the vendor's air controller, as specified in the 100% Design. The vendor's air regulator filtered particles down to 35 microns, while the design specifications call for filtration down to 5 microns. The variance request form indicates the Remedial Trust modified the variance and accepted the regulator and related change in filter particle size.
- VR-029 involved a request to substitute Hancor HDPE Hi-Q pipe for perforated FRP pipe on the north slope of the East Hide Pile. The Remedial Trust reviewed the variance request and specified that approval was contingent upon submittal of the pipe costs. Roux Associates was unable to find any documentation supporting the submittal of the pipe costs. However, all photographed pipes appear to be HDPE, as identified in corresponding field notes.
- VR-031 indicates that RUST Remedial Services Inc. requested a variation of DSCR-030-R1 to change the method of placement of riprap over 16-ounce geotextile. The riprap placement was to be performed in accordance with Section 02271-3.01(b) of the 100% Design Report specifications. The Remedial Trust and Design Engineers reviewed this variance request and modified the request, but did not approve it. Their modification required testing of the procedures to be conducted prior to approval of the variance request. Based on Roux Associates' research of available records, including Design Engineer Field Books and Quality Assurance Documents, no evidence was identified that the required testing was conducted or that this design modification was implemented on the Site. Therefore, the tasks discussed in this variance request do not affect the integrity of the cover.

- VR-034 involved a request for a three foot minimum overlap of geocomposite over geotextile for hide pile toe drains. The variance was proposed to improve construction methods. The Remedial Trust and Design Engineers reviewed this variance request and modified the request, but did not approve it. Their modification required screws be installed a minimum of every three feet. Roux Associates reviewed relevant field inspection reports and confirmed the geotextile and geocomposite were in compliance with the specifications. Furthermore, photos of the toe drains corroborate that screws were installed appropriately.
- VR-036 involved a request to reduce the Continuous Emissions Monitoring System (CEMS) operation and maintenance. Reducing the operation and maintenance time would consequently reduce costs. The Remedial Trust and Design Engineers reviewed this variance request and modified the request, but did not approve it. Their modification required the CEMS be operational by February 1995. Roux Associates conducted extensive research to determine whether the CEMS was operational by February 1995 and concluded that the available documentation is insufficient in proving the CEMS was operational by that date. However, Roux Associates has also concluded that the request was a financial management issue, and as such, had no technical implications for whether the CEMS was properly constructed.
- VR-039 involved a request to modify header piping in the gas collection system to accommodate relocation of Vaults 1 and 2. The Remedial Trust and Design Engineers reviewed this variance request and modified the request, but did not approve it. Their modification required solid piping to be installed on the side of each vault after the butterfly valve. Roux Associates reviewed relevant photos of the vaults and confirmed that solid piping was, in fact, installed on the side of each vault after the butterfly valve.
- VR-048 involved a request to hold a 3H:1V grade on the southwest side of the East Hide Pile, moving the limit of the cover to the east an estimated 10 feet. The Remedial Trust responded that 3H:1V should be the minimum slope steepness and that the slope should not be steeper than 3H:1V. Furthermore, the Remedial Trust specified in VR-048 Rev. that the toe drain on the slope should be installed in its original location. Roux Associates confirmed the toe drain was, in fact, installed in its original location, as detailed in the as-built drawings for the East Hide Pile.
- VR-056 involved a request to modify the geocomposite butt seam method. The Remedial Trust modified the variance and specified the usage of six-ounce geotextile and no melting damage to that geotextile. Based on relevant geotextile inspection reports, Roux Associates has concluded all geotextile on the subject property was inspected appropriately by the Remedial Trust and found to be in compliance.
- VR-060 required modification to the CEMS to be provided by DataTest because the proposed system did not conform with the 100% design requirements. Subsequent to this VR a different CEMS was designed and installed. Because the DataTest CEMS was not included in final construction, VR-060 is not relevant, and does not affect the integrity of the cover.

- VR-061 indicated that changes to the eastern beginning of the north slope drainage swale on the East Hide Pile affected the geomembrane edge. The changes were a result of the easternmost gas collection system vault being deleted. The Remedial Trust modified the variance and specified the changes be documented in the as-built record drawings. Roux Associates subsequently confirmed the geomembrane location, as detailed in the as-built record drawings.
- VR-063 involved a request to leister and bolt the geotextile/geocomposite seam along the eastern edge of the East Hide Pile. The Remedial Trust modified the variance to specify seaming over a French drain in the area, provided the metals screws were placed not to damage adjacent geomembrane. Existing field notes from December 1994 document no screws were put in the geosynthetic materials in a damaging fashion.
- VR-077 involved a request for polyfelt 16-oz. geotextile to be accepted with a minimum apparent opening size (AOS) of 70. The Remedial Trust modified the request and specified that geotextile with a minimum AOS of 70 or higher could be placed in upland areas. However, only geotextile with an AOS of 100 or more could be placed as wetland cover. According to the as-built drawings of the East Hide Pile, Roux Associates has confirmed that the geotextile placement on the subject properties is in compliance with this variance request.
- VR-079 indicates that site screened soil would be used in areas where slopes were up to 2.5:1, rather than 8:1 as required by the specifications. The VR was amended to reference the specification section, and provide additional justification for the approval. The VR was not signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover.
- CAR-012 and CAR-013 indicated that asphalt binder thicknesses and compactions failed on the subject property. The CARs noted that no corrective action was required due to repairs potentially causing additional damage. However, the CAR forms were not signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cap. Based on elevation survey information provided by Meridian, the minimum thickness for the cap cover was achieved throughout the subject property. Therefore, Roux Associates has determined the test failures of asphalt binder thickness and compaction on the subject property do not affect the integrity of the cap.
- CAR-029 involved a request to change the minimum thickness of cover soil in a small area at the base of the southern loading dock on the subject parcel from 16 inches to 6 inches. Further excavation to emplace the cover soil would have compromised the integrity of the building foundation. The request was approved in DSCR-037 on October 25, 1993. Note that although the as-built survey does not show final cover soil thickness, it is clear from the approved design changes that the as-built conditions met the approved design requirements.
- CAR-042 indicates that dredged soil was not properly handled as hazardous and was placed in the north end of the Aberjona River. The CAR required that the dredged soils be removed and the river bank repaired. The CAR lists corrective actions as pending, however, as-built drawings for the north end of the Aberjona River show

correct sloping and materials in the affected area. The CAR was not closed or signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover.

- CAR-056 indicated that the asphalt binder thickness and compaction failed at the northeast corner of the WJP Realty Trust property (Tax Map 9-7-4). The CAR noted that no corrective action would be required due to repairs potentially causing additional damage. However, the CAR form was not signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover. Based on elevation survey information provided by Meridian, the minimum thickness for the cover was achieved throughout the subject property. Therefore, the determination is made that any concerns related to the failure of the asphalt binder thickness and compaction do not affect the integrity of the cover.
- CAR-062 indicated that a flared-end section of pipe was cracked while in transport to the site. The flared-end section of pipe was installed and mortared onto the trench drain. The CAR indicates that additional mortar work is required. The CAR form was not signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover. It appears that the pipe was installed as planned and the potential for additional mortar work would not affect the integrity of the cover.
- CAR-077 involved a request for the Contractor to remove and replace sod around a sign post on the 20 Atlantic Avenue Realty Trust property (Tax Map 10-1-5) to see if the geotextile was pierced by the sign post installed by the property owner after the completed construction of the cover. The contractor was to repair the subgrade, geotextile, and cover if necessary. The CAR form identifies the corrective action as “pending”. In addition, the form is not completely signed, nor did the request ever appear to be approved.

After the sign was installed on the property, Meridian surveyed two points adjacent to the sign post. The first point was located approximately five feet west of the post. The second point was located approximately 10 feet to the southeast of the post. At both survey points, design requirements for cover thickness and integrity were met and the damage, if any, incurred by the sign post installation was limited in extent. The sign has subsequently been removed, and a concrete pad constructed over the area by the owner.

Roux Associates has determined that the underlying engineered cover at this location was constructed in accordance with the 100% Design. It is unclear if the cover was damaged as a result of construction activities of the property owner. If the engineered cover was damaged, the concrete slab is performing as an adequate protective barrier that is consistent with an equivalent cover. This slab should be managed as equivalent cover until such time as future activities at this property require removal or modification of the slab. Conducting work to complete an inspection of the engineered cover to verify if damage occurred is not warranted and may actually cause damage to the cover system.

- CAR-078 indicated that the asphalt binder thickness and compaction failed at the northeast corner of the WJP Realty Trust property (Tax Map 9-7-4). The CAR noted that no corrective action would be required due to repairs potentially causing additional damage. However, the CAR form was not signed by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover. Based on elevation survey information provided by Meridian, the minimum thickness for the cover was achieved throughout the property. Therefore, the determination is made that any concerns related to the failure of the asphalt binder thickness and compaction do not affect the integrity of the cover.
- CAR-083 was unable to be located. The CAR Record Log indicated that CAR-083 was related to decommissioning of a concrete structure on the Boston Edison Company property (Tax Maps 9-7-3) on June 18, 1994, however CAR-083 could not be located in the project files. The engineer's field records from that day indicate that the 10' x 20' subsurface concrete structure was not demolished because it would satisfy minimum depth requirements at the conclusion of cover construction. The design engineer's field notes for the day also indicate that this decision was reviewed and approved. The concrete structure was otherwise covered in accordance with the 100% Design report. The loss of CAR-083 is, therefore an administrative discrepancy that does not affect the integrity of the cover.
- CRA-001 indicated that the drainage plan for the Boston Edison Company property (Tax Map 9-7-3) required modifications to accommodate the existing air sparging system and proposed cover. Details of the air sparging system and associated cover required the design and installation of a culvert. Roux evaluated the design and implementation of the culvert in an effort to determine if the estimated runoff would be effectively discharged through the culvert. Roux determined that the 24-inch culvert would adequately channel the estimated runoff from a 100-year stormwater event. However, the CAR form was not signed completely by the Remedial Trust. Based on additional research, the incomplete signatures appear to be an administrative discrepancy that does not affect the integrity of the cover.
- CRA-050 indicates that the flared end of the culvert at the east end of former wetland 2A was incorrectly placed. The CAR required the culvert to be relocated or the slope to be redesigned to accommodate the TOU access road. The CAR lists corrective actions as pending, however, as constructed, the TOU access road has not experienced slope failure. The CAR was not closed or signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover.
- CAR-067 indicates that fill was placed around a culvert over frozen ground. The CAR required the fill to be removed and properly placed, and lists the corrective action as pending. As constructed, there is no apparent settlement or damage to the culvert. The CAR was not closed or signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover.

- CAR-068 indicates that pipe misalignment caused a manhole to tilt. The manhole was required to be dismantled and re-constructed. The CAR indicates that the manhole was dismantled, but lists reconstruction as pending. Drawings show that the manhole has been reconstructed. The CAR was not closed or signed completely by the design engineer, which appears to be an administrative discrepancy that does not affect the integrity of the cover.
- Eight CRAs (CRA-002, CRA-004, CRA-005, CRA-006, CRA-009, CRA-013, CRA-015 and CRA-016) were submitted to the Remedial Trust for application on the Resources for Responsible Site Management property (Tax Map 5-1-1). However, all of the CRAs were rejected by the Remedial Trust, and thus, not implemented on the Site.
- Four additional variance requests (VR-022, VR-028, VR-045, and VR-052) were submitted to the Remedial Trust for approval. However, all four of the requests were rejected by the Remedial Trust, and were not implemented on the subject properties.
- Two property-specific design changes, DSCR-074 and CAR-085 were not evaluated. The record search did not produce any documentation regarding these changes. DSCR-074 addresses drainage around the West Hide Pile, while CAR-085 deals with placement of fill. Roux Associates visually inspected the West Hide Pile during June 2008. During the inspection no evidence of erosion or slope failure was observed. As a result, Roux Associates has determined that design changes regarding drainage and the placement of fill have not affected the integrity of the cover.
- The 100% Design Report, Part I drawings called for an at-grade permeable cover to be implemented on the southeast corner of the Boston Edison Company property (Tax Map 9-2-8) and the Koster Realty Trust Parcel 4 property (Tax Map 9-2-6) adjacent to the MBTA rail line. In the as-built Record Drawings, the design was modified from an at-grade permeable soil cover to an at-grade permeable gravel cover. This design change was not reflected in the relevant DSCRs, VRs, CRAs, and CARs for this property. The modified cover consisted of 13 inches of cover soil followed by 3 inches of gravel surface (AASHTO No. 57) on top of 6 oz. nonwoven geotextile. Since this design modification still meets the 16-inch cover requirement, Roux Associates has determined that the at-grade permeable gravel cover serves the intended cover and drainage functions of the at-grade permeable soil cover.
- A discrepancy between the 100% Design Report specifications and the Meridian as-built figures led to the discovery of an undocumented design change. The specifications in the 100% Design Report indicated that 6-inch stone was to be used in the drainage swale in the southeast portion of the WJP Realty Trust property (Tax Map 9-7-4). The Meridian as-built figures however described the riprap in the drainage swale as a mixture of 6-inch and 12-inch stone. Roux Associates verified through visual inspection that the stone utilized in the drainage swale is a mixture of 6-inch and 12-inch stone. The Certifying Engineer concluded that the use of this mixture was acceptable and in accordance with the design intent of the 6-inch riprap outlined in the 100% Design Report Specifications and does not affect the integrity of the cover.

- Three locations on the Aero Realty Trust Parcel 2 property (Tax Map 9-2-4) have documented pavement thicknesses that do not meet the requirements of the 100% design. During paving along New Boston Street, pavement thicknesses less than those specified in the 100% design were documented on numerous properties. These discrepancies were address in CAR-012, CAR-013, CAR-014, CAR-015, CAR-056, CAR-078 and CAR-079. The on-Site resident engineer approved the pavement as-constructed because a repair would have been more harmful than accepting the pavement as-is. Roux Associates has determined that although this parcel is not specifically address in these CARs, the condition is consistent with those accepted by these CARs. Additionally, an inspection of the parcel conducted by Roux Associates on August 29, 2008 found engineered asphalt cover on the parcel to be in adequate condition. Therefore, Roux Associates has concluded that the three areas that did not have asphalt thicknesses meeting the requirements of the 100% design are acceptable, and do not jeopardize the integrity of the cover.
- The 100% Design Report indicates that gabion walls were to be installed along the southern edge of the Chestnut Hill Realty Trust Property, along the Sunder K. and Hiro K. Ganglani property (Tax Map 10-1-10). However, Final Record Drawings indicate that a drainage channel was installed along the southern border of the Chestnut Hill Realty Trust Property parcel identified as Tax Map 10-1-11. The 100% Design plans indicated that the southern slope of the East-Central Hide Pile would have a steeper gradient than the Final Record Drawings indicate was constructed. Although no formal design change could be located, the design engineer's field notes indicate acceptance of this change, noting that the gabion walls were not needed due to the decrease in slope and that the drainage swale would be sufficient for the calculated surface water runoff from the south slope of the East-Central Hide Pile.
- Record Drawings indicate that 18-inch reinforced concrete pipes (RCP) were installed in the Commerce Way Extension area on the west side of the City of Woburn property. The RCPs were intended to drain Wetlands 3A and 3C. The 100% Design Report indicated that the existing 24-inch RCP at Wetlands 3A and 15-inch cast iron pipe at Wetlands 3C were to be extended 22 feet and 21 feet, respectively. Subsequently the RTC Cover Certification Report Record Drawings indicate that the 18-inch RCPs were removed and replaced with 24-inch RCP as part of the RTC cover installation. The 1997 construction plans for the Commerce Way Extension Phase I (CWE) project completed by Vanasse Hangen Brustlin, Inc. (VHB) indicated the installation of a new 24-inch RCP at Wetlands 3A and a new 30-inch RCP at Wetlands 3C. The CWE plans also indicated the construction of headwalls and trash racks at both RCP locations. Field inspection conducted by Roux Associates confirmed the location and dimensions of the 24-inch RCP and the 30-inch RCP. Headwalls and trash racks were installed in both locations. While the initial 18-inch RCP installation did not meet the 100% Design Report specifications, the installation of the 24-inch and 30-inch RCP exceed the 100% Design Report specifications, and require no further action.
- MBTA approved ballast stone meeting the specification for AREA No. 4 aggregate, was substituted for AASHTO No. 57 stone on Engineered Gravel Surface Cover on this property. No design change documentation was prepared for this change, however Roux Associates has determined that this change does not affect the integrity of the cover.

- Following the construction of the cover, the gravel access road to the TOU building was paved. Maverick has reported that the pavement consists of a 2-inch binder course and a 1½ inch finish course for a total thickness of 3 ½ inches. Since this pavement was constructed above the finished cover, no testing or as-built surveys were prepared. This pavement did not alter the completed cover.
- Following the construction of the cover on the West Hide Pile, an area on the east side of the hide pile eroded during a major storm. The washed out area was repaired through the leveling of the remaining cover soil, installation of geotextile over the re-graded soil, and filling of the area with a 16-inch thick layer of stone. The stone used was a mixture of 1 ½ inch stone and rip rap. The repair formed a drainage swale on the east side of the hide pile, as shown on Record Drawings C-30 and C-33.

Additionally, Record Drawings B-12 through B-14 depict a change in the extent of Class C land in the western portion of this property, indicating that the land on this property had been re-classified as Class B land. These drawings reference a report by Golder Associates, dated October 12, 1995. No further information is available regarding this change in land classification. During preparation of this report, Remedial Trust personnel interviewed EPA personnel and EPA contractors who were present during cover construction. These personnel recalled the change, but could not provide further information or written records regarding the change. Roux Associates has performed the following research:

A comprehensive review of records regarding the construction of the OU-1 cover including review of all available design change documents, field notes, engineers log books, cover construction contractors notes, field investigation reports, meeting minutes, correspondence, and laboratory analytical reports;

A comprehensive review of records regarding design and construction of the Andersen Regional Transportation Center cover including review of all available design documents, design change documents, field notes, engineers log books, cover construction contractors notes, field investigation reports, meeting minutes, correspondence, and laboratory analytical reports; a screen of all other records and reports available in the Remedial Trusts files; and a review of documents available in EPA's New England Records Center.

This research has failed to locate a copy of or further reference to the October 12, 1995 report or other documentation supporting this change in land classification. Rous Associates has concluded that, based on historic knowledge of EPA and EPA Contractor personnel, that this change in land classification was accepted by EPA, however the documentation of this change has been misplaced. Elimination of cover within this area, therefore, is in compliance with an accepted change to the 100% cover design

Additional details and documentation of property-specific design changes are located in **Appendix C.**

9.0 QUALITY ASSURANCE OBSERVATION AND TESTING

Construction documentation includes daily field reports and weekly reports to the Remedial Trust. Inspection field diaries were also prepared, and photographs were taken on a regular basis throughout construction. The Golder reports and diaries are not included in this document, but are available for review at Golder's Manchester, New Hampshire office.

9.1 Decommissioning

Wells and piezometer abandonment operations were conducted under intermittent field observation by Golder as a representative of the Remedial Trust. The well decommissioning observations included:

- Verifying the submitted method and equipment to seal the well;
- Verifying the well depth and depth drilled;
- Verifying the diameter of over drill;
- Verifying the grout mix and volume used; and
- Verifying the final concrete cap.

A report of well decommissioning for the 73 monitoring wells, five well points, 14 piezometers, 15 boreholes, and 36 previously unidentified wells, located on the Site was prepared by Maher. A list of the decommissioned wells and the individual decommission logs are presented in **Appendix E**. Roux Associates reviewed the reports for conformance with the decommissioning procedures. Based on the well decommissioning records prepared by Maher, the wells were decommissioned in conformance with the 100% Design Report specifications. The locations of decommissioned wells are shown on the record drawings (Attachment 1).

Decommissioning of underground concrete tanks, steel tanks, abandoned pipelines, vaults or pits, concrete slabs, above ground steel tanks, gas pumps, above ground structures, and the features listed on the decommissioning plan, sheet 11-5 of the 100% Design Report were intermittently observed by Golder as a representative for the Remedial Trust. These features were decommissioned as part of the RTC cover installation and are addressed in the "Final Report on RTC Cover Certification" dated April 1998 by Golder.

9.2 Compacted Fill

Field moisture-density tests were generally performed at least once per 5,000 square feet per lift using a Troxler Model 3440 Nuclear Density gauge. Golder periodically monitored the soil testing operations performed by PSI. Failing tests were retested. During 1993 to 1994 the Contractor performed soil moisture density tests as quality control testing. The QC testing was performed by Express Geotesting, Concord, Massachusetts.

9.3 Subgrade Preparation

Subgrade preparation was inspected by Golder or PSI and the Contractor prior to geotextile deployment. A subgrade inspection form was prepared by Golder, PSI, or the Contractor for areas in which deployment would take place. Subgrade inspection forms are provided in **Appendix I.1**.

9.4 Permeable Cover

Geotextile was deployed over the prepared subgrade and seamed. The seams were inspected by Golder or PSI and the Contractor to verify the connection. A geotextile seam inspection form was prepared by Golder, PSI, or the Contractor. Geotextile seam inspection forms are provided in **Appendix I.2**.

Cover soil was placed as permeable cover over the geotextile in accordance with the 100% Design Report, and was nominally compacted by the placing equipment. No inspection or testing was required according to the 100% Design Report. Surveyors verified the cover thickness prior to placing topsoil or gravel. Topsoil, soil amendments, and seeds were then added, and the seed germinated with rainfall or water applied from water trucks. The quality of vegetative cover was evaluated. Erosion control matting was utilized in areas where seed did not germinate well.

9.5 Impermeable Liner Installation

Material used in construction of the drainage swale impermeable cover consisted of a 60-mil thick HDPE geomembrane liner. The HDPE was manufactured by NSC at NSC's Galesburg, Illinois facility.

The geomembrane liner installer for the project was NSC located in Reno, Nevada.

During deployment of the geomembrane liner panels the following services were provided by Golder personnel:

- Measurement of the panel thickness;
- Confirmation of panel overlap;
- Visual observation of overall sheet quality; and
- Assignment of a unique identification number to each panel deployment.

A nominal overlap of 6 inches was maintained between adjoining panels. The average panel thickness was determined by averaging five measurements made along each of the leading edge and trailing edge. A summary of Golder's deployment observations is presented in **Appendix H.5.2**.

Trial seams were made by each welding apparatus at the start of each day, and at least once every five hours while seaming. Sample coupons were cut from each end of the trial seam and tested in the peel and shear test modes using a calibrated tensiometer supplied by NSC.

If a trial seam failed the field testing, the welder and welding apparatus associated with the failing trial seam were not allowed to weld on the geomembrane liner until a passing trial seam had been made in accordance with the 100% Design Report specifications. A summary of the trial seam results is presented in **Appendix H.5.3** and **H.5.4**.

The geomembrane liner panel seaming process proceeded concurrently with the panel deployment. The majority of the seams were made using a dual, hot-wedge fusion welding apparatus. Repairs and some of the butt-seams between panels were made using an extrusion welding apparatus. The seaming operations were observed and documented by Golder personnel. The entire length of all seams, patches, or other repairs were observed and documented either during or shortly after completion. A summary of seaming operations, fusion and extrusion welds, is presented in **Appendix H.5.5** and **H.5.6**.

Samples for destructive testing were obtained from the seams of the 60-mil geomembrane liner system at an average frequency of at least one destructive test sample for each 500 feet of welding for each seaming apparatus. The test locations were selected by Golder personnel based on either completion of approximately 500 feet of welding or by observations of the welded seams. Destructive samples were tested off-Site by Golder Construction's Geosynthetic Laboratory.

Ten test coupons were cut from each destructive test sample. Five coupons were tested for adhesion (peel test mode) and five coupons were tested for bonded seam strength (shear test mode). In the event that a destructive test sample failed, the path of the welder was traced in both directions from the location of the failed test sample and the seam was re-sampled and retested at intervals that generally ranged from 10 to 20 feet until the failed destructive test was bounded in both directions by passing test samples. The section of seam between the passing test samples were then reconstructed between the test samples.

All nondestructive seam continuity testing was performed by NSC personnel and observed by Golder personnel. Three types of non-destructive testing were used for this project.

- Vacuum box testing on extrusion welds;
- Air pressure testing on dual hot wedge fusion welds; and
- Electric spark testing on extrusion welds used particularly around the vaults.

A vacuum box is a rigid wall box with a clear Plexiglas top and neoprene gasket around the bottom of the box that acts as a seal between the box and the HDPE liner. Vacuum box testing consisted of:

- Applying a soapy water solution to the seam;
- Placing the vacuum box over the seam;
- Applying a vacuum at least two to four pounds per square inch (psi) to the inside of the box for 10 seconds; and
- Observing the seam for bubbles, indicating a discontinuity in the seam.

Air pressure testing consisted of:

- Sealing off of the air channel between the inside and outside tracks of the fusion weld;
- Inserting a needle with a pressure gauge attached into the air channel;
- Using an air compressor, inflating the air channel to between 25 to 30 psi; and
- Observing the air pressure gauge over a period of 5 minutes to see if it maintains minimum pressure.

Electric spark testing consisted of:

- Embedding a copper wire in the extruded seam;
- Charging the embedded wire with a high voltage;
- Passing a brass bristled brush from the test unit over the entire seam length; and
- Observing an audible sound from the unit or a spark at any point of leakage where the current in the wire grounds to the brass brush.

Defects in the geomembrane liner were assigned unique identification numbers and were located and marked in the field by Golder personnel for repair. The defects were repaired and non-destructively tested by NSC in accordance with the 100% Design Report specifications.

9.6 Geocomposite Drainage

Geocomposite provided for drainage above the geomembrane in the impermeable cover on the East Hide Pile. A geocomposite seam inspection form was prepared by Golder, PSI, or the Contractor for geocomposite seams. Geocomposite forms are provided in **Appendix I.3**.

9.7 Geogrid Reinforcing

Geogrid was deployed for use in the permeable cover for securing the cover soil veneer on the West Hide Pile where slopes were steeper than 33 percent. A geogrid inspection form was prepared by Golder, PSI or the Contractor for seaming the geogrid together. Geogrid inspection forms are provided in **Appendix I.4**.

9.8 Manholes and Culverts

Pre-cast reinforced concrete culverts, outlet control structures, drain inlets and trench drains were installed as part of the Remedial Action to redirect surface and stream flows. Golder intermittently observed construction of these concrete features. Alignment and elevation of culverts were verified by survey. Golder inspections of pre-cast concrete structures consisted of:

- Observing the material dimensions and condition;
- Confirming the joint connections; and
- Confirming joint or void mortaring.

Part of the Remedial Design required cleaning and removing sediments that collected in existing culverts. Culverts to be cleaned were located in the Atlantic Avenue drainway.

9.9 Seeding and Wetland Vegetation

Calculations for soil loss, based on the United States Department of Agriculture (USDA) Soil Loss Equation, verify assumptions of the topsoil type, anticipated rainfall, vegetative cover type, and slope steepness are still valid with a calculated loss of less than 2 tons per acre per year. Erosion control matting was installed as a temporary measure to supplement the vegetated cover when the remaining growing season was too short to establish protective vegetative growth.

10.0 RECORD DRAWINGS

Based on the Survey Control (Section 5.0) established for the Industri-Plex Site, Record Drawings of the as-built conditions were established for the soil, sediment and air remedies constructed at the Site, and certified by a Massachusetts Land Surveyor (Meridian Land Services, Inc.). The Record Drawings for the Site are included in Attachment 1.

The Record Drawings include an elaborate survey network and extensive details on the horizontal and vertical locations of the various protective covers installed for the soil, sediment and air remedies. These details may aid in the future monitoring and management of the remedy, and Institutional Controls/Grant of Environmental Restrictions for the Site. The Record Drawings also illustrate the Institutional Controls/Grant of Environmental Restrictions boundaries denoted as Class A, B, C and D Lands.

Where located in Class C lands, existing concrete structures such as concrete pads, stairways, ramps, and loading docks remained in-place as an equivalent cover. These structures are similar to cover types 4, paved equivalent cover, and 5, building equivalent cover. However, because they were not specifically identified in the 100% Design Report, they have not been identified as a specific equivalent cover type herein.

The Record Drawings have plan views and points charts. The plan view shows grid points and intermediate point locations. The points chart shows elevation data collected at each point shown on the plan view. The plan views include contour lines for subgrade and finish grade. A summary of the separate sections of the Record Drawings is as follows:

- Sheets A-1 to A-10: Site Wide Record Drawings
- Sheets A-11 to A-15: Koster Revocable Trust – Parcel 1 (Tax Map 4-7-9)
- Sheets A-16 to A-20: Koster Revocable Trust – Parcel 2 (Tax Map 9-2-1)
- Sheets A-21 to A-25: Aero Realty Trust – Parcel 1 (Tax Map 9-2-3)
- Sheets A-26 to A-30: Aero Realty Trust – Parcel 2 (Tax Map 9-2-4)
- Sheets A-31 to A-35: Koster Nominee Trust – Parcel 3 (Tax Map 9-2-5)
- Sheets A-36 to A-40: Koster Revocable Trust – Parcel 4 (Tax Map 9-2-6)
- Sheets A-41 to A-45: Stephen & Adeline Dagata (Tax Map 9-2-7)
- Sheets A-46 to A-53: Boston Edison Company – Parcel 1 (Tax Map 9-2-6)
- Sheets A-54 to A-58: Boston Edison Company – Parcel 2 (Tax Map 9-7-3)
- Sheets A-59 to A-63: Boston Edison Company – Parcel 3 (Tax Map 9-1-5)

- Sheets A-64 to A-68: Positive Start Realty, Inc. (Tax Map 9-1-6)
- Sheets A-69 to A-73: PX Realty Trust – Parcel 1 (Tax Map 9-1-7)
- Sheets A-74 to A-87: PX Realty Trust – Parcel 2 (Tax Map 9-1-8)
- Sheets A-88 to A-92: WJP Realty Trust (Tax Map 9-7-4)
- Sheets A-93 to A-100: Massachusetts Bay Transportation Authority
- Sheets A-101 to A-108: Boston Edison Company – Parcel 4 (Tax Map 15-1-11)
- Sheets B-1 to B-10: Site Wide Record Drawings
- Sheets B-11 to B-15: Atlantic Avenue Associates, Inc. (Tax Map 10-1-6)
- Sheets B-16 to B-20: 20 Atlantic Avenue Realty Trust (Tax Map 10-1-5)
- Sheets B-21 to B-25: Mid A Terrace, LLC (Tax Map 10-1-4)
- Sheets B-26 to B-30: Nodraer Realty Corporation (Tax map 10-1-3)
- Sheets B-31 to B-35: Sunder K. & Hiro K Ganglani (Tax Map 10-1-10)
- Sheets B-36 to B-40: Pacer Headquarters, Inc. (Tax Map 10-1-2)
- Sheets C-1 to C-10: Site Wide Record Drawings
- Sheets C-11 to C-18: Chestnut Hill Realty Trust (Tax Maps 10-1-9, 10-1-11 & 10-1-12)
- Sheets C-19 to C-23: City of Woburn (Tax Map 10-1-17)
- Sheets C-24 to C-28: Resources for Responsible Site Management, Inc. (Tax Map 5-1-3)
- Sheets C-29 to C-33: Resources for Responsible Site Management, Inc. – West Hide Pile (Tax Map 5-1-1)
- Sheets C-34 to C-38: Resources for Responsible Site Management, Inc. – Wetlands 1C and Undeveloped Properties (Tax Map 5-1-1)
- Sheets C-40 to C-48: Resources for Responsible Site Management, Inc. – East Hide Pile (Tax Map 5-1-1)
- Sheets C-49 to C-55: Tabby Associates, LLC (Tax Map 4-7-1)
- Sheets C-56 to C-62: Resources for Responsible Site Management, Inc. – South Hide Pile & Detention Basin (Tax Map 10-1-6)

11.0 CERTIFICATION

On behalf of the Remedial Trust, Roux Associates certifies that the Industri-Plex remedial action was completed in compliance with the approved remedial design and work plans, approved design variances, and the Consent Decree. Any exceptions to the design are noted within this Cover Certification Report. Changes to the cover made following construction completion on June 28, 1996 are not addressed in this report. Approved changes to the cover made since that date are documented in the Administrative Record. The Professional Engineer's certification (below) comprises a declaration of his professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it release any other party of their responsibility to abide by contract documents or applicable codes, standards, regulations, and ordinances.

The Professional Engineer's certification is based upon a review of the remedial action documentation. Roux Associates' certification relies upon the accuracy of the as-built survey and record drawings prepared by Meridian and upon the representations made and information provided by the Remedial Trust and its representatives, contractors and consultants involved with the remedial action effort, EPA, and EPA contractors involved with the oversight of the remedial action effort. The Remedial Trust contractors and consultants include CWM, Golder, PSI, NAO, Datatest Industries, and Maverick.

Respectfully Submitted,
ROUX ASSOCIATES, INC.



Glen Gordon, P.E.
Certifying Engineer for Roux Associates, Inc.
MA License No. 41819



Lawrence McTiernan, LSP
Project Principal

Table 1
ISRT Clean Soil Thresholds
in milligrams per kilogram (mg/kg)

Adapted from Table 02223-1

The following table is presented as the clean soil guideline for the Industri-Plex (I-Plex) Site. Metals which are naturally rock-forming compounds may vary from the guideline values on a case by case basis.

Tests		Proposed Threshold Levels for Clean Soil Used at I-Plex		
<i>Volatile Organic (TCL)</i>	Non-detectable (3)	EPA Method	8240	
<i>Acid/Base Neutrals (TCL)</i>	Non-detectable (3)	EPA Method	3550/8270/8270	
<i>Pesticides/PCBs (TCL)</i>	Non-detectable	EPA Method	3550/8080	
<i>Metals - Target Analyte List (TAL) (4)</i>				
Aluminum	< 100,000 mg/kg	EPA Method	3050/6010	
Antimony	< 10 mg/kg	EPA Method	3050/6010	
Arsenic	< 25 mg/kg	EPA Method	3050/7060	
Barium	< 500 mg/kg	EPA Method	3050/6010	
Beryllium	< 1 mg/kg	EPA Method	3050/6010	
Cadmium	< 10 mg/kg	EPA Method	3050/6010	
Calcium	< 50,000 mg/kg	EPA Method	3050/6010	
Chromium	< 23 mg/kg	EPA Method	3050/6010	
Cobalt	< 20 mg/kg	EPA Method	3050/6010	
Copper	< 50 mg/kg	EPA Method	3050/6010	
Iron	< 70,000 mg/kg	EPA Method	3050/7420	
Lead	< 87 mg/kg	EPA Method	3050/6010	
Magnesium	< 10,000 mg/kg	EPA Method	3050/6010	
Manganese	< 1,000 mg/kg	EPA Method	3050/6010	
Mercury	< 1 mg/kg	EPA Method	3050/7470	
Nickel	< 100 mg/kg	EPA Method	3050/6010	
Potassium	< 10,000 mg/kg	EPA Method	3050/6010	
Selenium	< 20 mg/kg	EPA Method	3050/7740	
Silver	< 20 mg/kg	EPA Method	3050/6010	
Sodium	< 4,000 mg/kg	EPA Method	3050/6010	
Thallium	< 5 mg/kg	EPA Method	3050/7840	
Vanadium	< 150 mg/kg	EPA Method	3050/6010	
Zinc	< 200 mg/kg	EPA Method	3050/6010	
Cyanide	< 10 mg/kg	EPA Method	9010	
TPH (Total Petroleum Hydrocarbon)	< 200 mg/kg	EPA Method	418.1	

Notes:

- 1) At any time the Trust may revise this list to include testing for additional constituents which may pose a health threat.
- 2) TCL = Target Compound List
- 3) Excludes common laboratory contaminants given in the EPA Region 1 Contract Laboratory Program Data Validation Functional Guidelines.
- 4) TAL Metals by Inductively Coupled Plasma (ICP) and Atomic Absorption (AA) Methods, Test 6010, except run the following constituents by the following methods: (As) 7060, (Pb) 7420, (Se) 7740, (Th) 7840, (Hg) 7470. The 7000's are "furnace and cold vapor AA" methods.

Table 2
Testing Methods for Soil and Geosynthetics
 adapted from Golder's QAPP Table 1-1

7.2 TESTING METHODS	STANDARD	PRECONSTRUCTION FREQUENCY	CONSTRUCTION FREQUENCY
BACKFILL & FILL (Specification Section 02223)			
Backfill and fill tests will be performed by Professional Service Industries, Inc.			
Compacted Fill			
Gradation Test	ASTM D422	1/Source	1/5,000 CY
Plasticity Index	ASTM D4318	1/Source	1/5,000 CY
Standard Compaction	ASTM D698	1/Source	1/5,000 CY
Modified Compaction	ASTM D1557	1/Source	1/5,000 CY
Field Moisture/Density	ASTM D2922	Not Required	9/Lift or 1/100 LF
In-Place Methods	ASTM D1556 or D2167	Not Required	1/Day
Sand Bedding			
Gradation Test	ASTM D422	1/Source	1/5,000 CY
Carbonate Content	ASTM D3042	1/Source	Not Required
SUBANGULAR STONE (Specification Section 02233)			
Subangular stone tests will be performed by Professional Service Industries, Inc.			
AASHTO No. 2, 57, 67			
Gradation Test	ASTM D422	1/Source	1/1,000 CY
Carbonate Content	ASTM D3042	1/Source	Not Required
AASHTO No. 8			
Gradation Test	ASTM D422	1/Source	1/1,000 CY
Carbonate Content	ASTM D3042	1/Source	Not Required
Permeability Test	USCO EM1110-2-1905	1/Source	Not Required
IMPERMEABLE & PERMEABLE COVER FILL (Specification Section 02242)			
Impermeable and permeable cover fill test will be performed by Professional Service Industries, Inc. unless designated with **			
Cover Soil (Select Cover Fill)			
Gradation Test	ASTM D422	1/Source	1/2,000 CY
Plasticity Index	ASTM D4318	1/Source	1/5,000 CY
Direct Shear Test**	Section 02242	1/Source	1/2,000 CY
** Test to be performed by Golder Associates Ltd.			
Top Soil			
Gradation Test	ASTM D422	1/Source	1/2,000 CY
pH Test	ASTM D4972	1/Source	Not Required
Baker Soil Fertility Test**	Section 02242	1/Source	1/2,000 CY
** Test to be performed by Land Management Decisions, Inc.			
WETLANDS SEDIMENT REMEDIATION COVER SOILS (Specification Section 02243)			
Wetland sediment cover soil tests will be performed by Professional Service Industries, Inc. unless designated with **			
Wetland Gravel (Road Structural Fill: Section 02223)			
Gradation Test	ASTM D422	1/Source	1/5,000 CY
Wetland Topsoil (Topsoil: Section 02937)			
Gradation Test	ASTM D422	1/Source	1/5,000 CY
pH Test	ASTM D4972	1/Source	1/5,000 CY
Organic Matter Content	Section 02937, Tbl 2	1/Source	1/5,000 CY
Soil Fertility Test**	Section 02937, Tbl 2	1/Source	1/5,000 CY
** Test to be performed by Land Management Decisions, Inc.			
STREAM SEDIMENT REMEDIATION COVER (Specification Section 02244)			
Stream sediment cover tests will be performed by Professional Service Industries, Inc.			
Gravel/Cobble (Section 02271)			
Abrasion Test	ASTM C535	Not Required	Not Required
Freeze Thaw Test	AASHTO T103	Not Required	Not Required
Specific Gravity	ASTM C127	Not Required	Not Required
Gradation Test-Aggregate	ASTM C136	1/Source	Not Required

Table 2
Testing Methods for Soil and Geosynthetics
 adapted from Golder's QAPP Table 1-1

7.2 TESTING METHODS	STANDARD	PRECONSTRUCTION FREQUENCY	CONSTRUCTION FREQUENCY
STONE RIPRAP (Specification Section 02271) Stone riprap tests will be performed by Professional Service Industries, Inc.			
Gravel/Cobble (d_{50}=3 inches) (Section 02271)			
Abrasion Test	ASTM C535	Not Required	Not Required
Freeze Thaw Test	AASHTO T103	Not Required	Not Required
Specific Gravity	ASTM C127	Not Required	Not Required
Gradation Test-Aggregate	ASTM C136	1/Source	Not Required
Streambed Sediment Filter and Gabion Rock (d_{50}=6 inches)			
Abrasion Test	ASTM C535	Not Required	Not Required
Freeze Thaw Test	AASHTO T103	Not Required	Not Required
Specific Gravity	ASTM C127	Not Required	Not Required
Gradation Test-Aggregate	ASTM C136	1/Source	Not Required
SUBBASE AND PAVEMENT (Specification Section 02575) Subbase and Pavement tests will be performed by Professional Service Industries, Inc.			
Graded Aggregate Base Course			
Gradation Test	AASHTO T11 & T27	1/Source	1/5,000 SY or 1 Day
Compacted Density	AASHTO T180 Method D	1/Source	1/5,000 SY or 1 Day
Abrasion Test*	AASHTO T96	1/Source	1/5,000 SY or 1 Day
Freeze Thaw Test*	AASHTO T103	1/Source	1/5,000 SY or 1 Day
(* as required by MDPW specifications)			
Binding and Wearing Asphalt Courses			
Extraction Test (Plant)	AASHTO T168	Not Required	1/500 Tons
Gradation Test (Plant)	AASHTO T11 or T27	Not Required	1/500 Tons
Density/Stability (Plant)	AASHTO T209, T245, T246, T247	Not Required	1/500 Tons
Max. Theoretical Density	ASTM D2041	Not Required	1/500 Tons
Max. Density - Marshall	AASHTO T209 or T245	Not Required	2/500 Tons
In place Density	ASTM D2950	Not Required	1/100 LF
In place Density (Core)	AASHTO T166	Not Required	1 Core/500 SY
In place Thickness (Core)	AASHTO T166	Not Required	1 Core/500 SY
In place Smoothness Test	Section 02575	Not Required	1/100 LF
GEOTEXTILE (Specification Section 02595) Geotextile tests will be performed by Golder Construction Services, Inc.			
Non-woven, 6, 10, and 16 ounces/square yard			
Mass Per Unit Area	ASTM D5261	1/100,000 SF	Not Required
Grab Strength	ASTM D4632	1/100,000 SF	Not Required
Trapezoidal Tear Strength	ASTM D4533	1/100,000 SF	Not Required
Burst Strength	ASTM D3786	1/100,000 SF	Not Required
Puncture Strength	ASTM D4833	1/100,000 SF	Not Required
Thickness	ASTM D5199	1/100,000 SF	Not Required
Apparent Opening Size	ASTM D4751	1/100,000 SF	Not Required
GEOMEMBRANE (Specification Section 02597) Geomembrane tests will be performed by Golder Construction Services, Inc.			
Textured HDPE			
Thickness	ASTM D5199	1/100,000 SF	Not Required
Density	ASTM D1505	1/100,000 SF	Not Required
Minimum Tensile Properties:	ASTM D638	1/100,000 SF	Not Required
Tensile Strength, Yield			
Tensile Strength, Break			
Elongation at Yield			
Elongation at Break			
Tear Resistance	ASTM D1004 Die C	Not Required	Not Required
Low Temperature Brittleness	ASTM D746 Proc. B	Not Required	Not Required
Dimensional Stability	ASTM D1204	1/100,000 SF	Not Required
Environmental Stress Crack	ASTM D1693	Not Required	Not Required
Puncture Resistance	FTMS 101C Method 206C	Not Required	Not Required
Carbon Black Content	ASTM D1603	1/100,000 SF	Not Required
Carbon Black Dispersion	ASTM D3015	1/100,000 SF	Not Required
Shear Test	ASTM D4437 NSF Mod.	Not Required	1/500 LF
Peel Adhesion (Hot Wedge Fusion Weld)	ASTM D4437 NSF Mod.	Not Required	1/500 LF
Peel Adhesion (Fillet Extrusion Weld)	ASTM D4437 NSF Mod.	Not Required	1/500 LF

Table 2
Testing Methods for Soil and Geosynthetics
 adapted from Golder's QAPP Table 1-1

7.2 TESTING METHODS	STANDARD	PRECONSTRUCTION FREQUENCY	CONSTRUCTION FREQUENCY
GEOCOMPOSITE (Specification Section 02598)			
Geocomposite tests will be performed by Golder Construction Services, Inc.			
Geocomposite (TEX-NET TN3002CN)			
Geocomposite Transmissivity @ 500 psf; Gradient = 1	ASTM D4716	1/100,000 SF	Not Required
Geocomposite Transmissivity @ 20,000 psf; Gradient = 1	ASTM D4716	1/100,000 SF	Not Required
Tensile Strength - Net only (prior to lamination)	ASTM D5035	Not Required	Not Required
Tensile Strength - Geotextile only (prior to lamination)	ASTM D4632	Not Required	Not Required
Geocomposite Peel Strength	ASTM D413	1/100,000 SF	Not Required
Density - Net only (prior to lamination)	ASTM D1505	Not Required	Not Required
Carbon Black Content - Net only (prior to lamination)	ASTM D1603	Not Required	Not Required
Thickness - Net only (prior to lamination)	ASTM D5199	Not Required	Not Required
Thickness - Geotextile only (prior to lamination)	ASTM D5199	Not Required	Not Required
Geotextile Mass/Unit Area	ASTM D5261	1/100,000 SF	Not Required
Apparent Opening Size - Geotextile only (prior to lamination)	ASTM D4751	Not Required	Not Required
GEOGRID (Specification Section 02599)			
Geocomposite tests will be performed by Golder Construction Services, Inc.			
Geocomposite (TEX-NET TN3002CN)			
Open Area	COE CW 02215-89	1/100,000 SF	Not Required
Thickness:	ASTM D5199	1/100,000 SF	Not Required
Ribs			
Junctions			
Long Term Design Load (MD)	ASTM D5282	Not Required	Not Required
Flexural Rigidity	ASTM D1388	1/100,000 SF	Not Required
Geogrid Rib Tensile Strength	GRI GG1	1/100,000 SF	Not Required
Junction Node Strength	GRI GG2	1/100,000 SF	Not Required
Strength			
Efficiency			
Density	ASTM D1248	1/100,000 SF	Not Required
Carbon Black Content	ASTM D1603	1/100,000 SF	Not Required
WETLAND MITIGATION (Specification Section 02937)			
Wetland sediment cover soil tests will be performed by Professional Service Industries, Inc. unless designated with "**			
Wetland Cover Soil			
Gravation Test	ASTM D422	1/Source	1/Acre/Lift
Plasticity Index	ASTM D4318	1/Source	1/Acre/Lift
Standard Compaction	ASTM D698	1/Source	1/Source
Flexible Wall Perm Test **	ASTM D5084	1/Source	1/Acre/Lift
Field Moisture/Density	ASTM D2922	Not Required	1/10,000 SF
** Test will be performed by Golder Associates, Inc.			
CAST IN PLACE CONCRETE (Specification Section 03300)			
Cast in place concrete tests will be performed by Professional Service Industries, Inc.			
Compression Test Cylinders	ASTM C39	Not Required	4/Class/100 CY to
Making of Test Cylinders	ASTM C31	Not Required	4/Class/5,000 SF of
Testing of Aggregate	ASTM C33	Not Required	Concrete Place As

Notes:

QAPP = Quality Assurance Project Plan

ASTM = American Society for Testing and Materials

CY = cubic yard

LF = linear feet

AASHTO = American Association of State Highway and Transportation Officials

Tbl = Table

MDPW = Massachusetts Department of Public Works

SF = square foot

PSF = pounds per square foot

Table 3
Summary of Abbreviations
Property-Specific Cover Certification Reports
Industri-Plex Site

Mapping Location:

@	=	at
AAD	=	Atlantic Avenue Drainway
AL	=	Above Geotextile
AP	=	Above Pipe
BECO	=	Boston Edison Company right of way
BLDG	=	Building
BRD	=	Bradford
BSG	=	Below Subgrade
BTOB	=	Below Top of berm
CO	=	Company
COMM	=	Commerce (Way Extension)
DET	=	Detention Basin
E	=	East
EEOS	=	East End of Seam
ECHP	=	East Central Hide Pile
EXT	=	Extension
HUB	=	Hubbardston
MID	=	Middle
N	=	North
PLYM	=	Plymouth
PRES	=	Presidential (Way Extension)
REV	=	Revere
S	=	South
SEOS	=	South End of Seam
SG	=	Subgrade
STK	=	Stock (yard)
UGT	=	Under Ground Tank
UTIL	=	Utility
W	=	West
w/	=	with
WEOS	=	West End of Seam
WIL	=	Wilmington
WOB	=	Woburn

Cover Materials:

GB	=	Gravel Borrow (Subbase)
LL	=	Liquid Limit
MOIST	=	Optimum Moisture Content
NP	=	Non-Plastic
PCF	=	Pounds per Cubic Foot
PL	=	Plastic Limit
PSI	=	Pounds per Square Inch
PROC	=	Processed
SCRND	=	Screened
SD	=	Sand
SS	=	Site Soil
TRI	=	(Bardon) Trimount

Table 4
Cover Design Change Applicability

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Table 4
Cover Design Change Applicability

	Pacer Headquarters, Inc.	Resources for Responsible Site Management	Koster Revocable Trust (Parcel 1)	Koster Revocable Trust (Parcel 2)	Koster Nominee Trust (Parcel 3)	Koster Revocable Trust (Parcel 4)	Aero Realty Trust (Parcel 1)	PX Realty Trust (Parcel 1)	Positive Start Realty Inc.	WJP Realty Trust (Formerly PEBSCO)	Stephen & Adeline Dagata	20 Atlantic Avenue Realty Trust	Atlantic Avenue Associates, Inc.	Mid A Terrace LLC (Formerly Atlantic Ave. Trust)	Boston Edison Company	Nodraer Realty Trust	Sunder K. & Hiro K. Gangani	Chestnut Hill Realty Trust	Resources for Responsible Site Management	Resources for Responsible Site Management (undeveloped)	PX Realty Trust (Parcel 2)	Tabby Associates, LLC	City of Woburn	Rights of Ways and Roads	Massachusetts Bay Transportation Authority	Aero Realty Trust (Parcel 2)
Tax Map Parcel Number	10-1-2	10-1-6	4-7-9	9-2-1	9-2-5	9-2-6	9-2-3	9-1-7	9-1-6	9-7-4	9-2-7	10-1-5	10-1-8	10-1-4	9-7-3 9-1-5 15-1-11	10-1-3	10-1-10	10-1-9 10-1-11 10-1-12	5-1-1	5-1-3	9-1-8	4-7-1	10-1-17	N/A	31-2-2	9-2-4
CORRECTIVE ACTION REQUESTS (CARs)																										
CAR-001	A	A																								
CAR-002											B													B		
CAR-003											B													B		
CAR-004										B														B		
CAR-005																								B		
CAR-006										B	B													B		
CAR-007																								B		
CAR-008										B														B		
CAR-009																										
CAR-010																		B								
CAR-011										B																
CAR-012											B													B		B
CAR-013											B													B		B
CAR-014																								B		B
CAR-015																								B		B
CAR-016																		B						B		B
CAR-017						B												B		B				B		
CAR-018										B																
CAR-019															B											
CAR-020															B											
CAR-021															B											
CAR-022															B											
CAR-023															B			B	B	B						
CAR-024															B											
CAR-025															B											
CAR-026																			B							
CAR-027										B					B											
CAR-028																		B		B						
CAR-029			C															B								
CAR-030			B		B																					
CAR-031									B															B		
CAR-032																			B							
CAR-033					B																			B		
CAR-034										B																
CAR-035																			B							
CAR-036			B																					B		
CAR-037																										
CAR-038																			B							
CAR-039																			B							
CAR-040										B														B		
CAR-041																		B		B						
CAR-042																			B							
CAR-043										B																
CAR-044										B																
CAR-045			B																					B		
CAR-046																			B							
CAR-047																			B					B		
CAR-048											B															
CAR-049																			B							
CAR-050																			B							
CAR-051																					B					
CAR-052																					B					
CAR-053	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
CAR-054																					B			B		
CAR-055			B	B	B	B	B	B	B		B													B		B
CAR-056											C															C
CAR-057										B																
CAR-058						B																		B		B
CAR-059																			B							
CAR-060										B																
CAR-061											B				B											
CAR-062										B																
CAR-063																										
CAR-064																					B					
CAR-065											B										B			B		
CAR-066											B															
CAR-067																			B							
CAR-068																			B							
CAR-069															B											
CAR-070															B											
CAR-071	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
CAR-072																								B		
CAR-073																										
CAR-074																					B					
CAR-075																					B					
CAR-076																					B					
CAR-077						C															B					
CAR-078										B																B
CAR-079																					B					B
CAR-080																					B					
CAR-081																					B					
CAR-082																										
CAR-083																B										
CAR-084																										
CAR-085																										

Table 4
Cover Design Change Applicability

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	Pacer Headquarters, Inc.	Resources for Responsible Site Management	Koster Revocable Trust (Parcel 1)	Koster Revocable Trust (Parcel 2)	Koster Nominee Trust (Parcel 3)	Koster Revocable Trust (Parcel 4)	Aero Realty Trust (Parcel 1)	PX Realty Trust (Parcel 1)	Positive Start Realty Inc.	WJP Realty Trust (Formerly PEBCO)	Stephen & Adeline Dagata	20 Atlantic Avenue Realty Trust	Atlantic Avenue Associates, Inc.	Mid A Terrace LLC (Formerly Atlantic Ave. Trust)	Boston Edison Company	Nodrner Realty Trust	Sunder K. & Hiro K. Gangani	Chestnut Hill Realty Trust	Resources for Responsible Site Management	Resources for Responsible Site Management (undeveloped)	PX Realty Trust (Parcel 2)	Tabby Associates, LLC	City of Woburn	Rights of Ways and Roads	Massachusetts Bay Transportation Authority	Aero Realty Trust (Parcel 2)
Tax Map Parcel Number	10-1-2	10-1-6	4-7-9	9-2-1	9-2-5	9-2-6	9-2-3	9-1-7	9-1-6	9-7-4	9-2-7	10-1-5	10-1-8	10-1-4	9-2-8 9-7-3 9-1-5 15-1-11	10-1-3	10-1-10	10-1-9 10-1-11 10-1-12	5-1-1	5-1-3	9-1-8	4-7-1	10-1-17	N/A	31-2-2	9-2-4
CHANGE REQUEST AUTHORIZATIONS (CRAs)																										
CRA-001															B											
CRA-002																			A							
CRA-003																			A			A				
CRA-004																			D							
CRA-005																			D			D				
CRA-006															D											
CRA-007																										
CRA-008																			A						A	
CRA-009																			D							
CRA-010															F						D					
CRA-011																									A	
CRA-012																			A			A				
CRA-013																			A			A				
CRA-014																			A							
CRA-015																										
CRA-016	A	A																D	D	D			D			
CRA-017																		D	D	D						
CRA-018																										
CRA-019																										
CRA-020																										

LEGEND
A Signed and Approved
B Administrative Discrepancy
Other Discrepancy
D Rejected
F Administrative Change – Does Not Alter Design or Construction of Cover